



# TomTom

# Next in Navigation

Tuesday 24<sup>th</sup> September 2019

<b>List of MAIN speakers</b>	<b>Company</b>	<b>Job title</b>
Cees van Dok	TomTom	Chief Product Officer

### **Next in Navigation Slide #1**

**Cees van Dok**  
*Chief Product Officer*

So, I'm Cees van Dok. I am Chief Product Officer at TomTom. I've been with the company for about eight years and I've always been deeply involved in the end user experience of both automotive as well as consumer products. And I would like to spend the next 15 to 20 minutes to give you a heads up, a view, of how we think the customer user experience will evolve.

And also, how we think we can take a differentiating position in navigation in comparison to the competitive field.

### **“Automakers are being outperformed by smartphone software providers” Slide #2**

But before I do that, let me zoom in a little bit closer on Antoine already described that the automotive industry, and especially software in automotive, is in times of disruption.

There are a couple of couple of key enablers that are that are happening in that in that space. First of all, I think we see auto motive software makers struggle, if not failing, to meet customer expectations and customer expectations have rapidly evolved because of mobile phone usage and this is a quote from J.D. power. J.D. power is a well-respected automotive consultancy voice of customer company in the US.

And they reported last year that about 20% of new car owners with navigation in the car actually never uses navigation. And an even higher percentage is stopping the use of embedded navigation in the first 90 days of their new car usage and instead people flock to their phones. So, they trust phones for navigation and other kind of digital life experiences that they expect to be able to continue to use in the car when they move from all these other context into there into the car.

And that obviously is because the experience delivered on phone is by far superior to what you get in most cars, in terms of up to date software, in terms of fresh content, speed of user experience. So that's the first point.

### **2007 Remember this? Slide #3**

Another point is that the paradigm shift that happened in the mobile phone industry about a decade ago is now happening also in the automotive industry.

### **It's happening again Slide #4**

So, where you see the replacement of a lot of feature value and end customer value through hardware controls shifting to a software first way of delivering that value is a paradigm shift that is now

happening in automotive and that delay is obviously because of the nature of the industry where development cycles of cars are taking a very long time but also because these disruptive elements are happening.

Now, what you see in the car space is that the environment becomes more familiar to what users expect from their daily life experiences. So, the car becomes more like how you interact with your phone, your TV, with your home automation software. So, we see a vast reduction in hardware controls and buttons and levers and controls, as you see on the left, and are much more software centric. User experience driven by voice, by touch, and by a limited set of steering wheel controls.

### **Google Automotive Services (GAS) are disrupting the status quo Slide #5**

So, now obviously a third disruptor is the entrance of Google in the car. So, Google Automotive Services went from mobile first to Android Auto to becoming really embedded in the car, bringing the, as I just quoted before, phenomenal Google Maps experience in the automotive environment, which is obviously a big shift from where most carmakers are today.

Now the question is how are we, as TomTom, going to deal with that and how we think there is a path forward in our navigation software user experience.

### **Product strategy Slide #6**

And we identified four different pillars which we which we base our strategy on. First of all is to be really mobile competitive and to embrace the best practices of the phone industry and the mobile industry, more applied to our own full stack of navigation products.

So, rather than having embedded maps and having software that runs in the car, we are currently in transition of shifting all of that to an online reality and making sure that part of our navigation software is all running in the cloud. We had a lot of proof points this morning about maps moving to the cloud, so embracing the paradigm and being online first is currently happening and I'll show you some proof points of that.

Integrating with user's digital life is a part of that. So, how can we bridge the value and the service that people trust on their phone? How we can bring that into car and make the transition as smooth as possible. Connectivity is obviously required, and that has always been a difficult discussion with automotive makers. Broadband connectivity delivers the best user experience, but it also comes at a cost.

So, is that cause being transition to the to the user? Is that taken by the OEM? It's a difficult position to move forward, but it's essential to deliver a strong user experience. And lastly, being voice centric is key. So, in the car, safety is what we are all about and interacting with software and features through a lot of manual actions is quite unsafe, so we're building were creating, we're preparing ourselves for a voice first user experience of our navigation software.

The second part of the strategy is to really differentiate in navigation itself. So, rather than a relying on mobile derived smartphone based navigation only, we feel there is a position for navigation to be more integrated in the car itself and it was mentioned a few times like taking ADAS as an example and I'll show a few more examples of that later in the presentation, taking all of the data that the car generates, the sensor data, what the car's observing its environment are perfect data points and

feedback mechanisms for drivers to integrate into the navigation experience and I'll show a few examples of that.

Thirdly, we feel we need to also zoom out of navigation only. So, currently our navigation software is often part of an in-vehicle infotainment system where many other applications are collected in order to deliver an end-to-end user experience and all of those applications often have their own user interface paradigm, their own way of working, their own way that their information is being organised and being accessed and we feel strongly about creating a more holistic way of interfacing with that software in the car.

So, how you control software, how you control it by voice and by touch, any by other ways of input. We want to create a view where moving from say communication to entertainments to navigation to controlling features in the car feels much more the same across all those application. And that's obviously zooming out from navigation only, but we feel by only focusing on such a more holistic user experience we can actually deliver a more delightful and better user experience for car drivers.

And lastly, we don't do this alone. So, it was mentioned to MCVP is an important technology partner. So, having a robust, scalable cloud platform that enables a great in-car user experience where you have authentication, a good data collection in the cloud, lots of services with high quality and high speed delivery into the vehicle is essential, but also on the voice assistant to angle, it is not technology that we would ever develop within our own company but relying on the right complimentary partners to provide that more holistic user experience is the way to go and redeveloping those partnerships as we speak.

Close collaboration with OEMs is another important angle. We are, I think, OEM-friendly. We work with OEMs. We have deep engagements and partnerships with OEMs to together build solutions and for our next wave in navigation or IVI that is not any different. So, understanding OEMs' needs and requirements when it comes to customisation to create a user experience that feels authentic to their brand rather than a broadened solution by a third party is an essential element there.

### **Mobile competitive – TomTom AmiGO Slide #7**

Now zooming into a couple of proof points. So, we're moving out navigation stick to an online first reality and TomTom AmiGO is the first proof point of that, so we are developing as we speak a lightweight navigation application where all of the navigation software runs in the cloud. It runs online. So, all your maps search and routing and all those aspects around navigation are coming from the network and there's only a small lightweight application footprint happening on the client.

And what we're trying to do with AmiGO is to extend the already great presence that we have with end customers because we believe end customer and the relationship with end customers is the way to ultimately deliver the most delightful experience is possible that we then bring to our automotive customers.

AmiGO is in open beta on the Android platform. It was released a few weeks ago, so if you have an Android phone and you have the TomTom speed cam app on your phone, you can upgrade to AmiGO to experience this lightweight turn by turn yourself.

### **IVI Concept Slide #8**

The second initiative that we've started is product concept development around, what I mentioned, this broader scope of IVI. So, we're currently doing a product development, concept development, around an end-to-end infotainment or in-car vehicle infotainment system. Again, also taking a view on how communication would work through the car: through your phone or through conference calling.

How entertainment would work. So, the ability to play to play music either streaming from the Internet, streaming music from your Phone, or from connected music services and how that all interplays with navigation without any application switching and content switching. And redeveloping that view in order to again have a view towards OEMs of what we feel an integrated experience could look and feel like.

But also, to have a product that we can test with end customers and test with OEMs to see what kind of features would really stick and work for people.

### **The Navigation Opportunity Slide #9**

But let me dive in a little bit into the navigation opportunity itself. As I mentioned, we also feel that in navigation software and based on the stack of technology that we have from map to ADAS to autonomous driving HD data to live services, we feel that on top of the stack we can actually also play a larger role in the in-car vehicle experience by bringing those technologies together into a driver experience that is more front and centre, then what navigation is today.

### **Route guidance based on current lane Slide #10**

And I'll show you a few examples. So, this is a this is a demo that we built a few years ago. A real-world working proof of concept. It's based on HD data, so this is an HD map, rendered in 3D. And we take the camera position from the car into account in the navigation experience.

So, we see the accurate lane position where the car is in and we give this yellow bow wave nudge to move the driver into the into the right direction. So, rather than giving navigational instructions like take the right at the next junction, we can actually much more smoothly guide the user through the right lanes in order to make their navigation experience much more natural and much more fluid compared to today.

And that can only be done by taking not only the map data from our map service and integrated in the navigation experience, but also take information from the car sensor data locally in the car and bring that together into one unified user experience.

### **First step – Moving lane guidance Slide #11**

So, a proof point that we're also shipping with this kind of technology already, so this is not only concept work, is in our most recent version of the TomTom Go Navigation application, which is more like our embedded apps. Premium navigation application, where we brought this whole concept of

moving lanes into the user experience and this is actually one of the differentiating features in that application.

And again, by bringing in sensor data, we can enrich that even further.

### **A problem: Where to look? Slide #12**

And that's also trying to address a real-world problem. Because if you take a driver in a modern car today, there are quite a lot of different places in the car where they get their feedback from in order to take navigation and driving decisions. For example, they may have a screen or a phone with navigation software running on them. They may have a next instruction panel right in front of them or in the centre stack display.

There may be all sort of warning mechanisms like gentle warnings coming from a live service. There can be specific hardware-based features like collision detection, blind spot detection that can sit in the mirror in the display right in front of the driver. There can be collision warnings, little LED screens in yet another location or on the steering wheel.

We're getting all sort of cryptic visualisations about more advanced features. So, for example, this is the user feedback for L2 driving where the car sticks to the lane and keeps the distance to the car in front of it. Sometimes it's even more cryptic little icons that light up somewhere. And then there's the outside world information that the user also needs to digest and understand in order to take decisions and that can be a simple message that can also be part of the ADAS map or it can be a much more complex message that is quite difficult to parse when you're driving by quite fast.

### **Where's the chef with the recipe? Slide #13**

So, we believe we have a position to take all that information and bring it all together into a unified driver-centric user experience because this whole hodgepodge of features that are springing up across the car feels a bit like a bunch of ingredients where the chef and the recipe is missing.

### **Fusing feedback from various sources Slide #14**

And we think we can play a role there. So, this image brings a couple of those items together where we see a view on the road ahead, and that is not an unfamiliar view from road users expect from navigation today, but it has a lot more information. So, this is not only a green line that gives you guidance, but it's also an HD map that gives you a real-world view about what you see out of the windshield. It gives you sensor feedback. There is a car on the right of me that is trying to merge to the left. The car actually observes that manoeuvre and warns me for it.

So, it's a much richer experience. So, we bring in this setup to gather our map. Obviously, ADAS data, routing and guidance as we know it, it also brings in information that is coming from the traffic service, live services. So, doing a jam tail warning with a jam that is around the around the corner is integrated, but also as I mentioned this sensor feedback from the car itself.

So, imagine my car detecting another car in a blind spot or there's a collision warning or, as I've shown before, this late position thinking, we bring all of that into that same visualization and that goes all the way up to the deeper levels of automation. So, this view can also guide users towards autonomous

driving in the end. We know that the adoption of autonomous driving is very much a user trust and a safety issue. Users will need to get to trust their car to make the right decisions and that all starts with building trust through visualization.

So, if the car can explain very clearly to the driver, what's happening outside, what kind of decisions it's going to make, how it's going to move, what kind of manoeuvres it's going to make, the better that trust building will happen. So, this is not just about next generation navigation, but it's also a view on how that can expand to an autonomous reality further down the road.

#### **Fusion Navigation Concepts (Collision warning) Slide #15**

And here's a couple of visualisations of how we think we can bring that to life. So, imagine this is the cluster display in front of the driver. Here's an example of a collision detection integrated into navigation. Here another example of a blind spot detection. So, I'm instructed to move to the left, but there's actually another car to the left of me so it's not safe to take that manoeuvre and as soon as the car has passed, I get the green light or the blue light in this case and I can move over to the centre lane.

#### **Fusion Navigation Concepts (Lane Keep Assist) Slide #16**

Another example is, as I mentioned, Level 2 automation, so the car sticks to the lane it's in. We visualise that by a couple lines next to the line that I'm currently in and as soon as it needs to change speed because there's another car in front of him, again, we use that same kind of rendering environment to visualise that context. It's a little hard to see but there's a white car in front of him in this is being checked. But again, also for online information.

#### **Fusion Navigation Concepts (Traffic Jam Tail) Slide #17**

So, if we know there is traffic around the corner and you're approaching it is too fast, we can do our jam tail warnings of over speeding in that exact same context.

#### **Fusion Navigation Concepts (Autonomous Driving Zone) Slide #18**

And lastly, an example around how that could even transfer into autonomous driving. So, there's an autonomous driving coming up. The driver is informed about that zone now coming up. There's a handover to the autonomous car system and again all that information is being brought into one place.

So, rather than sprinkling dialogues and messages and beeps and notifications all over the place, we believe that a view on the road of the next couple of hundred meters in front of you is going to be an area that we are very familiar with. We're been rendering that view since our very first PNDs and we believe that there is a strong possibility to naturally grow that into a next wave of navigation.