

Harry Ridgewell: Sorry. Can you please just say your name?

Pritt Vinkel: Yes, my name's Priit, head of the Estonian State Election Office.

Harry Ridgewell: Right. So how secure is Estonia's online voting system?

Pritt Vinkel: Well, that's such a terrible question. It's really hard to actually answer that quickly, but it is as secure as other e-solution that we are using in the government system here in Estonia.

Harry Ridgewell: And so are there not dangers that somebody's vote could be traced back to the individual, and it could be found out that who voted and how they voted?

Pritt Vinkel: For that we have procedures, that we have some really, I'd say, hardened already for 12 years, used procedure norms that have to be fulfilled. And that would achieve the in confidant or keep the anonymity. We use these two facts, private, public key [inaudible 00:01:16]. And by using that, we have a proper civility to keep [inaudible 00:01:24] in a time without the possibility of anybody else, before the tally time, to actually discredit or ... well, already, a look at the documents on our webpage here and a more legal systems actually.

Harry Ridgewell: Sorry, hang on. I am just moving somewhere where I think there will be better internet connection because you were slightly breaking up there. So is it as secure as a traditional paper ballot system, where people would come and vote in person?

Pritt Vinkel: Yes, I think you can't compare them fully, but you can be sure that the principles that are there for voting their methods can be assured the same way. So, yeah, in paper voting, we rely heavily on the human factor, that the election workers are complicit and do all their duties correctly. And the internet world, in this [inaudible 00:02:37] case, we rely heavily on procedures and routines. So, yeah, those are some guarantees the voting [systems 00:02:45] are secure.

Harry Ridgewell: And what do you make of Princeton University and Michigan University's findings that they said the system could be easily hackable?

Pritt Vinkel: Well, first of all, all these presumptions they had and all these allegations were made based on their own built [inaudible 00:03:12] like conditions that are highly theoretical. They also approached us in 2014 with findings that we had lots of discussions with them and we were able to demonstrate also to them, that in the actual e-voting environment, and in the actual case that we have here in Estonia, these risks are not [inaudible 00:03:41] that have come out. There are always, always risks involved with every [inaudible 00:03:49] the internet, to have to be aware that [inaudible 00:03:52] actually can prove, and someone can just pen and paper. We are really, really well aware of all the criticisms from their part, but as lots of their those pre-requisitions that they put on the table. And then they [inaudible 00:04:11] trusts do not take into account the Estonian one already established here, like the eID infrastructure and the

situation, where we are in the practical world, as in lots of those things could easily be turned over so soon.

Harry Ridgewell: And so the OSCE and the ODIHR, I know that they have some criticisms. And then I think they produced a report. And then I think I saw a report you produced saying that you would identify their criticisms, and you were going to recommend you would implement some of that recommendations. Have you done that?

Pritt Vinkel: Yeah. We talking about the 20[inaudible 00:04:56] elections and the report that the ODIHR produced after that then all these remarks ... They were not criticisms but remarks, because Estonia, at the moment, filled one of the unicorns, so to say, in the field of internet voting in elections. And we have to say that all these remarks in one or another way have been implemented in our system. In 2017, we introduced a fully enhanced new framework of internet voting, introducing end to end verifiability into the system. And these are lots of changes have enhanced the possibility for the voter and also for the system or the observers and the data auditors to check the system from the beginning to the end. So lots of things were changed in the 2017 [inaudible 00:05:54]. So, yeah, we have changed lots of them, we try to change it before and after every execution of the system because we can't rely on previous technology and the knowledge because internet is evolving so fast.

Harry Ridgewell: And I read that an activist from the Estonian Pirate Party called ... I'm probably going to pronounce his name wrong ... but [Mark Podder 00:06:19]?

Pritt Vinkel: Yes.

Harry Ridgewell: He took credit for casting an invalid ballot. Do you believe that to be true?

Pritt Vinkel: Yes. So for the acceptable ways of casting the ballot, in the standard law, it's possible to have an invalid ballot. That's in the paper voting solution and in the e-voting solution. If you are savvy enough to open the lead from the election programme, and you put in [inaudible 00:06:56] the way [inaudible 00:06:58] ballot say if you write a poem or something else on the ballot, not the number of the candidate, that makes it valid, and you get an invalid ballot. So these are comparable things and yes, he has proven that it can be done, and this is really legal.

Harry Ridgewell: Can internet voting be done securely without national identity cards?

Pritt Vinkel: These are difficult questions because, in our case, in the Estonian case, this is one of the most important [factors 00:07:32], but [inaudible 00:07:34] in the voting system, because it would be really hard to actually make sure, first of all, how to trust the way of making sure who the person is behind the computer. [inaudible 00:07:47] the eID infrastructure through the fact that everybody using their everyday life. In all of these different other possibilities of voting, besides voting, giving signatures, doing their taxes too, and online banking. All the different e-government solutions that they use the eID. In Estonia, we can relate.

It's a safe way to relate, but I know there are countries that also have other trustworthy authentication methods and also [inaudible 00:08:26] methods. So thus to say, if they are trustworthy or ... In our case, we trust the eID solutions we have here. In other places, they might trust also other methods, and this might be a possibility in other places. Because we have, let's be honest, also the infrastructure, and this was the usage we have here in Estonia [inaudible 00:08:54].

Harry Ridgewell: And has Estonia experienced any state or reasonable scale cyber attacks since introducing online voting?

Pritt Vinkel: It has always been sort of knocks on the door, but nothing so vast and large magnitude that would somehow interfere with the voting process that we haven't had. And we also do a lot of operation inside voting, before instant voting, and also [inaudible 00:09:24] not do that. With all the [inaudible 00:09:28] we do a lot to actually secure also the networks, so to say, where all this [could 00:09:35].

Harry Ridgewell: Sorry, if you already said this ... the connection's very poor for me, but does Estonia's online voting have end to end verifiability? Because I believe ... from reading that it didn't used to ... but I was just wondering if it did now have end to end verifiability?

Pritt Vinkel: [inaudible 00:09:59] Yes, we're introduced our new work of elections, having end to end verifiability that is practically usable. But [inaudible 00:10:10] with to, so to say, theoretical possibilities that end to end could be achieved, and we have works out and enforced solution where the auditors can check the input and output automatically. So we have end to end verifiability together with voting [inaudible 00:10:29] all these features, our present sense to the 17 elections and have already been using them in election in 2017.

Harry Ridgewell: And why did Estonia decide to implement online voting?

Pritt Vinkel: It's really hard to say. In the very beginning, it was seen, actually, as a measure to keep the turnout numbers from declining, and I think that's something that has worked and worked. We have a quite stable turnout. People are used to use these convenient methods of voting and this ... The convenience aspect of it, I think, has been very important to [inaudible 00:11:12]. Also, the politicians thought this would attract younger people to voting. And, unfortunately, what the service showed now, after nine executions in 12 years, that unfortunately, young people tend to be attracted to other things [inaudible 00:11:30] purely by such a nominative system. So to say, they need other incentives, other motivations when it comes to voting. So we haven't seen a really strong spike in young people, but the overall acceptance of internet voting in the general population has been overwhelming.

Pritt Vinkel: So it must [inaudible 00:11:51] All the age groups have done ... All the different [inaudible 00:11:59] we would have and [inaudible 00:12:00] infrastructure

[inaudible 00:12:02]. We have a really important reason to have something like that so that we at least have the possibility to determine or make sure who the person behind the screen really is, why not also use this tool for elections, for voting? I think we started in the beginning of 2006 or 2007 [inaudible 00:12:25] the times, when compared to [inaudible 00:12:31] we are really different. So if you would ask whether it would be easy to actually implement something like [we D 00:12:39] 12 years ago, also, today, some person has ... times have changed, so I think it would be much harder to start from scratch at the moment.

Harry Ridgewell:

And how are you planning to make your online voting system more secure in the future? Oh, it's cut you out.

Re-establishing line...

Priit Vinkel: In the future, I'm not so sure whether it's going to be in five years or so to also have internet voting in Scotland. And, at the moment it's only possible to vote on PCs, Linux computers, or Mac computers too, iPhone or iPad. So, that's something we are analysing really really deeply at the moment whether we could analyse the risks of voting with handheld devices. This is something we have to work because the world around us is changing. So, in this process we have to keep it as secure as possible, also, on the PC platforms. It's really hard to say what kind of new features to add because it's working at the moment, and it's as secure as possible at the moment and this process is ongoing to make it also secure in the future.

Harry Ridgewell: Is the online voting system that you use now, is that cheaper or more expensive than the previous voting system that you used?

Priit Vinkel: Well, in Estonia we haven't used any other machines or any other voting system. We always have had the paper system as an alternative. And, of course, when we compare paper voting and the e-voting, the cost of casting one vote will be the difference is so that ... There's actually a scientific programme, or process going on at the moment in the University of Technology in Thailand, where they tried to put a price tag on all the different voting methods. And their preliminary results show that the difference is two or three fold, so that internet voting is cheaper because of the volume cost and then the first buy in are there although the costs are there but running it for a long time is cheaper than having the human cost of the... humans pay costs for every time you have an election. So, there's a difference.

Harry Ridgewell: So you said earlier that lots of attempts have been made to try and hack your online system, but they haven't been successful. Can you say which groups have tried to hack the online voting system?

Priit Vinkel: At the moment I don't have any concrete groups or individuals or any other actors in that matter, with the security [inaudible 00:02:52] is in the state diplomatics authority, that's who also has our cyber emergency response team when the [inaudible 00:03:04] are responsible for our cyber security needs. Before, during, and after the election. So they have a lot of information, too, it might be, but I think we haven't gotten any far. It would take for sure the tryouts or the locks on the door. So nothing mentioned.

Harry Ridgewell: And what effect, other than, well, what effect has online voting had on your elections and Parliament composition and voter turnout?

Priit Vinkel: The service and the research testing shows that it does not have an effect on the political outcome or the party landscape so to say. It is not somehow biased towards one party. What we see is that those people who, once use internet

voting tend to keep those [inaudible 00:04:01]. So it's a [inaudible 00:04:02] voting method. That, those people who vote tend to take part in elections in general. So it advances this voting election, so to say. And it especially has a strong effect on voting from abroad. So we have had, really, large raise in numbers coming votes from abroad. Some that before internet voting we just had some 40 different embassies and consulates all on board where you could vote on paper, but now there are no actual environmental limits. We have votes from more than 116 different places, different countries all over the world. So we have seen that this helps tremendously brings voting closer for those people who actually travel a lot, who are not in the vicinity of any traditional voting possibility during the elections and there we see a really, really strong grasp.

Harry Ridgewell: And, do you see any time in the sort of near future there coming a point where Estonia's voting ends up becoming exclusively online?

Priit Vinkel: No, I think the paper and the electronic voting difference shall stay, because there's always people who want to vote electronically, always want to do it more, some manually, go to the polling station, have a small ceremony there. Actually the last election in 2017 we had 16 year olds, 16, 17 year olds first time in our elections. And the research - [inaudible 00:06:09] And most of them actually went to a voting station, although they had the possibility to vote online. And that's mainly because of the initiating rights to be a grownup and vote, to do this on paper. So I think there's always going to be a need for the traditional way of voting but they're always be also those people [inaudible 00:06:33] use really gladly the possibility of e-voting.

Harry Ridgewell: And finally, can you, just in layman's terms, describe how the Estonian online voting system actually works and how someone casts a vote?

Priit Vinkel: So when we have our election period in Estonia, we don't have just one day of voting we have, in recent years, we have had ten day voting period. In this ten day voting period, seven days are allocated for internet voting and during this seven days voting, during this allotment period, you can vote 24 hours a day anywhere, in any computer. And what you have to do, you have to have your ID card or your digital mobile ID ready, that's actually the same certificates as you have on the ID card you have on the SIM card so they are different, like, tokens, that the Estonians can use for the ID.

Priit Vinkel: And you download a application and application has to download it, there's no browser based system, you have to download and application from it. You choose either your mobile id, traditional id, or your id card and you authenticate itself traditional ID and you authenticate yourself and you get [inaudible 00:08:00] And only your candidates shown, somebody can't mess with your, or any other candidacy. If you have more than one district, for example, or constituency, then you get only your special candidates shown and in this case as we have proportional election system, you would choose your candidate out of different [inaudible 00:08:22]. They have their own number shown on the screen, you scroll up and down, choose your candidate, pick the candidate by

clicking on the name and then you sign your vote, you sign your ballot, your e-ballot, by giving it a signature.

Priit Vinkel: It's a separate certificates for you have to use in the system and after everything, you can check if your computer worked fine by individually verifying your voting process by using your [inaudible 00:08:56]. You download this special application for Android or your iPhone, you take a QR picture of the QR code that's presented in the end of your voting procedure. And then through mathematical procedures, you are shown what kind of vote was sent away from this computer. But this can only be done after, 30 minutes after your voting process or three times of the election so you can be sure that your computer worked fine. Your computer-which is the weakest link- if it got corrupted or somehow [inaudible 00:09:35] You can see your result there and then this result is kept in the same system of a resolution your actual vote is encrypted, so nobody can actually decrypt it before the tally's done with this wishes on the end of the election week, end of the election day, election Sunday.

Priit Vinkel: Where the national committee, seven members, come together, everybody has one part of the opening key, the decryption key. The majority of them, four of them must be present to put their key into the system and so with the decryption process can start. So, at no point, nobody from the election organisation can actually determine how any person voted. We only know the fact that the person has actually voted so. And also, to guarantee secrecy and the freedom of the vote, it is possible in our system to vote as many times as you want electronically and your last vote counts. Or you vote both electronically and on paper, then your paper vote counts. So this is the so-called [inaudible 00:10:52] voting booth in order to give yourself the possibility to actually determine where you feel the safest and nobody is harassing you or isn't somehow challenged and you then give your last vote, last vote actually counts in the elections.

Harry Ridgewell: And sorry, very final question.

Priit Vinkel: Yep.

Harry Ridgewell: So even if the system is secure against state actors or organisations, conducting cyber attacks, how do you protect against individuals having viruses on their own computers? Because you can't really regulate how individuals users use their own computers, so they might use them very irresponsibly. [crosstalk 00:11:37]

Priit Vinkel: Indeed, indeed.

Harry Ridgewell: Yeah.

Priit Vinkel: The voter's computer is the weakest link in the whole system. But that's exactly why we have individual verifiability. There's possibility for every voter to actually check whether the voter, whether the computer, computer used for voting, was not somehow corrupted. And if something like that comes up, we have special

response teams that check the computer, check whether it is just one case or this has somehow spread. And different possibilities we can actually do. The person can go to another computer which is not corrupted and give the actual vote, he or she wanted to give if something is not like what they wanted.

Priit Vinkel: So we have to ask the voters to make sure that the computers are actually safe. And if we believe they are not, there's a contingency plan, from all sides. We have to deal with the possibilities there. And the votes as such can not bring any harm to the central system, so the possible risk of actors would be that the vote gives a vote for one candidate and somehow the computer sends away another vote. But exactly for that we have individual verifiability. And if at least two votes [inaudible 00:13:10]

Priit Vinkel: And we haven't got any large scale attacks or any reports that something was not right. We can say mathematically that everything was actually correct and this has now, the internet voting has been used for four elections now and we can say that all the time at least two percent verified and we can say that no large scale problems have been with the actual voting computers.

Harry Ridgewell: Okay, thank you. There was something else that I was going to ask you but it's gone....what was I going to ask you? God, what was I gonna ask you?

Priit Vinkel: Actually, if you have any questions more or you want to have a more picture of all I told you, we've got our own webpage and the English site, you have to enter 13 page and actually the XV framework we started 2013 and all these scientific surveys and they all present there, you'll find them on our webpage.

Harry Ridgewell: Ah! I remembered what it was! Have you had either politicians or voters after an election, inevitably-well, there's always, there's one winner and there's losers- have either political parties or politicians or even voters after an election complained and said that, "Oh our votes didn't work" or politicians said clearly the system didn't work because otherwise we would've won. Has that happened at all?

Priit Vinkel: Actually, that's always the case. The losers fight and want to find a reason why they lost a few votes. But there are procedures [inaudible 00:15:06] There are always procedures [inaudible 00:15:11] But then the complaint procedure has to be received by the National Election Committee and after that this goes directly to the Supreme Court. So the Supreme Court has to keep, after every election, has some kind of complaint that the procedures were not right and I am not trusting [inaudible 00:15:38] But after all the elections, always we've had these, looking over all the possible risks that could happen and so far we have been in the green so to say and also the Supreme Court never found that would somehow changed the votes or had brought the change in the election results. And of course there's always political parties that feel for particular reasons that are well against or sceptical of all e-solutions. Not only internet voting but also [inaudible 00:16:20]

Priit Vinkel:

So the far right parties for example or the politicians are a bit sceptical they want to be as conservative as possible, to have everything like it always has been. And so there's always a debate. Before elections, during elections, after elections. So this part of the process, you can't have a fully, how do you say...Well, if we have to debate the process we have to debate but we have to explain how we are doing things. And those people who are there to have the oversight powers and the jurisdiction to determine whether we need or have [inaudible 00:17:03] do their work, and so far it has all went well.

Harry Ridgewell:

Okay, thank you.