



***/review* presents:**
Putting the E in Estonia

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From cog in the Soviet machine to eGovernment pioneer: Estonia has come a long way in the past 25 years. This “startup nation” has built a streamlined digital infrastructure of cutting-edge public and private services from the ground up – and it is also a case study of how all countries could benefit from eGovernment



Like millions of other couples around the world, Kadri and Artur met in college. In the 10 years since, they have traveled, studied and worked in a number of countries. And like millions of others, they moved back to their home country, Estonia, when their daughter was born. But when little Berta arrived in August 2014, it became clear to Kadri and Artur that Estonia was very different from everywhere else they'd lived.

“I logged on to the state web portal and we registered the birth of our daughter there,” says Kadri. “It was where we officially named her. We filed the forms for child benefit payments, and then we checked through the web portal to see if the officials had received our forms, looked through them and approved them.” For Kadri, it’s unimaginable that she should have to use paper and pen to communicate with officials in her country.

Kadri and Artur aren’t an exceptional case. All Estonians benefit from the ease and efficiency of eGovernment services – and they simply can’t understand why all countries haven’t embraced the digital way of life.

In the beginning...

But let’s take a step back. Why is it that Estonia, a country of just 1.3 million people that is 60% covered by forest, has become an internationally recognized eGovernment leader?

Estonia became an independent nation in 1991 after 50 years under Soviet control. Its new leaders faced the daunting task of rebuilding government operations from scratch. But



rather than carrying on as before, they decided to take the opportunity to be genuinely pioneering – to think differently about how a government can work.

And so, in the 1990s, a group of about 20 scientists, government officials and business leaders started talking about eGovernment and a new form of ID. Linnar Viik, one of the small group of people who spearheaded the project when it began in the second half of the 1990s, says they had a powerful vision: to use technology to streamline administration and foster innovation in a country with otherwise scarce resources.

The idea was that the government would play an important role in creating a new authentication system, but that this would have to be done in conjunction with private companies

to ensure that the new system would be used both by the public and the private sectors.

A new kind of identification

One of the first developments was an ID card, which the Estonian government started rolling out in 2002. But these cards weren't simply for presenting to bank tellers or nightclub bouncers as a form of identification. They also had small chips in them that opened up a whole new virtual world.

Since its introduction in 2002, Estonians have used digital signature more than 200 million times

The Estonian eID card is part of the country's public key infrastructure (PKI), allowing citizens to use secure services online. It is secure and easy to use – all people needed is a card reader, and most Estonian computers come with one built in.

In that first year, 100,000 eID cards were issued – that's about 7% of Estonia's population, which was then about 1.4 million. Today, there are 1.1 million cards in use, or one each for 90% of the population.

"Did we expect that hundreds of thousands of people would race to use the eID card back in the year 2000? Not really," says Viik. "But we knew it was going to be a project that spanned many generations of technology. We were in it for the long haul."

The Estonian government and private sector played a large part in encouraging people to use their new eIDs. They started small, adding functionality such as train ticketing (more on this later), which demonstrated the eID's practicality and ease of use. They also provided terminals in public buildings that could be used by people who didn't have computers at home.

There's also now a Digi-ID, a secondary eID card for frequent users that can only be used online, rather than in person.

A complementary time-saving technology was also introduced in 2002: digital signature. This development meant that a document signed digitally had the same legal validity as a paper document signed the old-fashioned way. Now, Estonians had a secure and easy way to validate government documents, commercial agreements, bank transfers and many other documents digitally. No more wasting reams of paper or traveling to an office to physically sign a contract.

And Estonians have clearly realized its advantages: since its introduction, digital signature has been used more than 200 million times.

In 2007 came Mobile ID – a response to the slow but sure move from desktop to mobile computing. Mobile ID uses the same PKI as the eID card, but the data is stored on a secure SIM card in the phone. When a person logs in to an eService using Mobile ID, that website or app routes the authentication via the mobile network to the person's phone, where they are prompted for their PIN.





So far, so easy. Why aren't we all using these kinds of eServices? Karoli Hindriks, CEO of Estonian startup Jobbatical, acknowledges that it's far easier to introduce new technologies in a small country than in a large one. You need to convince fewer people that the new system works. "But the other thing is the mindset," she adds. "So I think it's the combination of a small country, historical details and the fact that we are open to change as a nation."

But with larger countries from the Netherlands to Korea having recognized the potential of eGovernment, this technology is within reach of every country, no matter what its size.

A digital Swiss Army knife

Mindset is one thing, but new technology has to work if it's going to last. And one reason Estonians have embraced the eID card is that it works for all sorts of things. Having established its usefulness for secure online authentication, Estonia took the next step and set up the world's first ID-based fare system in 2004. In Tallinn, the capital city, people could pay for their tram or bus fare using their eID cards. Paper tickets and cash were now unnecessary – passengers could just tap their cards on the reader. The card also functions as a driver's license, keeping wallets nice and slim.

Another service that helped convince Estonians of the value of eServices was online tax filing. When this service was first introduced in 2000, only about 3% of taxpayers used it. Two years later, the eID boosted its convenience – and

then came automated forms. Today, the Estonian Tax and Customs Board compiles the preliminary data automatically for every taxpayer, so it's just a matter of logging on to the website, having a quick look, adding information if necessary or proceeding immediately to digital signature.

It proved the boost the system needed. In 2013, 98% of people filed their taxes online – a figure that led to the government's decision to drop paper-based tax declarations altogether.

For most Estonians, declaring taxes takes a matter of moments. And that gives them more time to boast on Facebook: "I'm sitting in the bar. Just did my taxes, took me literally two minutes."

Hassle-free healthcare

When Kadri takes baby Berta to see the doctor, she sometimes leaves with a prescription. But it's not a regular paper prescription – it's all digital. Artur can then stop by the pharmacy after work and, using his ID card, collect the medication without having to get a paper prescription from Kadri. And as any parent knows, anything that saves even a few minutes is worth its weight in gold.

The system has worked well for five years and people have all but forgotten the small green paper prescriptions that doctors used to hand out. And doctors like it too: along with the system's time-saving benefits, they can check to see if their patients actually collected the prescription.

Such is its success that Estonia has developed a countrywide eHealth platform. This allows laboratories to send all of a particular person's medical information to one place, and doctors who are granted access privileges can log in wherever they are and get the latest results.

"That allows the next wave of institutions to build very interesting solutions on top of it," says Indrek Kask, CEO of eHealth startup LabToWellness. His company is analyzing the anonymized digital medical data being stored and coming up with easy-to-understand visualizations, algorithm-based interpretations and personalized lifestyle and product recommendations.

On the X-Road

Connecting all these services is X-Road, a virtual conduit that allows the secure exchange of information between authorized agencies. It's what makes Estonia's eServices possible, from tax declaration to registering a new baby.

Estonians have reaped many direct benefits from X-Road. For example, legislation requires bureaucrats to use existing data where possible. If, for instance, the Road Administration already has data about a person's car, then another agency can't make that person fill out another form with the same information.

Today, 900 organizations use X-Road every day, and more than half of Estonians use it through the country's web-based information portal, eesti.ee.

What about privacy? Even in a country that prides itself on its open-mindedness about new technology, no one wants their personal information available for all to see. And in Estonia, privacy is also built into the core of the information system: every person is the ultimate owner of his or her own data.

This is why on eesti.ee, everyone can view a log that shows exactly who – whether civil servants or accredited

professionals such as medical doctors – has accessed their personal data and when. Any unauthorized access is a criminal offense.

Ones and zeros, not Xs

While Estonia was the first in the world to introduce many eServices, other governments have recognized the charms of digital technology. But there's one thing that's unique to Estonia and may be for some time: online voting.

Other countries have experimented with it, but only Estonia has embraced it in a permanent way. Estonians voted online for the first time in the 2005 local elections and again in the 2007 parliamentary elections.

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It's been a real success story: the parliamentary elections of March 2015 set a new record, with more than 175,000 people voting online. That's almost a third of all voters and a 25% increase on the previous parliamentary elections in 2011.

To many observers, buffeted by a constant stream of hacking reports in the media, eVoting seems ripe for fraud. But Estonia's eID card infrastructure ensures the system is watertight. It has been critically analyzed a number of times by auditors and hackers, both in Estonia and abroad, but no practical weaknesses or vulnerabilities have been found.

Besides being technically secure, eVoting adheres to the same principles as traditional voting: everyone gets one vote, all votes are equal and it is not possible to trace the vote back to the person who cast it. And voters also have a second (and third, and fourth) chance: if for any reason they want to cast their vote again, they can either do it electronically or go to a physical polling station. Only their most recent vote counts.

The idea of eVoting is not to kill off paper-ballot voting but to get more people to vote, period. And it seems to be working: voter participation in parliamentary elections rose from 61.9% in 2007 to 64.2% in 2015.

Nationwide web

Of course, eGovernment services wouldn't be much use if your internet connection was either nonexistent or felt like it was powered by a donkey on a treadmill. But in Estonia, the internet is everywhere – and it's fast.

Naturally, it was pioneering in this area: it was one of the first countries in the world to introduce large public wireless internet areas, with the first appearing in 2001. Only a few



years later, free Wi-Fi was everywhere, from cafés and restaurants to schools and parks. In 2007, the bus service between Tallinn and Riga in Latvia became the first in the world to offer wireless internet access for passengers.

Soon after, the whole country had 3G coverage, and in February 2010, mobile operator EMT opened Estonia's first 4G mobile network. In 2013, when it became possible to use the 800 MHz band for countrywide 4G network deployment, EMT did it in four and a half weeks.

"It's the world record," Tiit Tammiste, Chief Technology Officer of EMT, says with palpable pride. Almost overnight, it became possible to find a fast internet connection wherever you were in Estonia, from a busy city center to the quiet green forests that cover more than half of the country.

"I think Estonia is the best-connected country in Europe," Tammiste says. "People are using the gadgets in all sorts of places; signing a contract in the middle of the forest is everyday practice here.

"People are using the 4G network a lot and the data growth is very good. We have almost half of our network traffic already in the 4G network."

This ubiquitous access has changed how Estonians view the world. "When you develop technology in Estonia, you come from the background that you have mobile internet everywhere," says Kristjan Maruste, CEO of coModule, which produces hardware and software components for electric bikes and scooters. "So you can develop mobile applications that are always connected through the cloud,

eResidents have access to Estonian eServices, starting with the robust security and simplicity of online authentication and digital signature

and you basically build your intelligence into the cloud. And then when you go to a foreign market, you figure out people are asking questions like, 'What if there is no signal?' You say, 'Yes, but that never happens' and they're like, 'No, no, it does happen.'"

Of course, being such a prominent eGovernment player is a red rag to hackers eager to show off their skills. Estonia found that out in 2007, when anti-government protests that turned violent brought with them a three-week wave of cyber attacks. National eServices, private companies, online banks and media publications were compromised.

But what doesn't kill you makes you stronger, and public and private companies have since invested heavily in bolstering



their cyber defense capabilities. NATO has even founded a Cyber Defense Center of Excellence in Tallinn.

Be a virtual Estonian

It's safe to say that Estonia has shed its startup status and has become an established force in eGovernment. The next step? To convince other countries that its way is the best way.

So, late in 2014, Estonia launched the next phase of its digital revolution: to offer its platform of digital services to the world. It began issuing eID cards to people who weren't citizens or even residents. These so-called eResidents have access to Estonian eServices, starting with the robust security and simplicity of online authentication and digital signature.

The aim is twofold: to make it easy for foreigners to start companies and conduct business in Estonia, and to promote the benefits of eServices.

Anyone can apply for eResidency, although immigration officers conduct a background check on applicants, and access to digital services doesn't give eResidents all the privileges citizens and residents enjoy.

Taavi Kotka is Undersecretary at the Ministry of Economic Affairs, or as he calls himself, the "CIO of Estonia." He is one of the eResident program's founders and has been a vocal evangelist for it inside and outside of the country.

"eResidency should be seen as a technical means to help foreigners connect with not only Estonia, but with Europe," he says.

Along with eIDAS, the European Union's revamped eID legislation, eResidency could help speed up digitalization for people who live in parts of the EU that have been slower to adopt eServices. "A German businessman who wants to do business with an Austrian one could make

his everyday affairs very efficient if he used Estonian digital identity,” Kotka says.

Although eResidency is still in its infancy, thousands of people have already signed up to learn more about it.

And the future?

Linnar Viik, the man who helped kick off Estonia's digital revolution in the 1990s, is happy. “The base architecture, strong authentication, strong eID card and strong certificates have taken Estonia to the point where we can safely say that the [system] produces value for society.”

At its heart, this is what e-Estonia's grand experiment is about: value. Not just monetary value, but creating a country where citizens have to spend less time on administration and more on the things that make them happy.

Simplicity, speed, privacy and digital inclusion are at the heart of Estonia's cultural and linguistic identity, underpinned by progressive public healthcare, education

for all and a respect for the environment. Its eServices have been built with all this in mind.

It's working. At the launch of eIDAS, Estonian President Toomas Hendrik Ilves said that the use of digital signature saves every adult the equivalent of one working week each year. And in Estonia alone, a stack of paper as high as the Eiffel Tower is saved every month by people signing their documents digitally.

But while most people choose to use eServices, the old systems remain: everyone can still sign contracts by hand, mail official forms at the post office, get paper prescriptions and vote by paper ballot at a polling station. There is a small but stalwart group of people who choose to continue their analog ways. But for how long?

“It is a very different Estonia for her compared with my childhood,” says Kadri, pushing her daughter in a stroller. Although their hometown of Tallinn is transforming in a visible way, with new buildings and infrastructure, she says the biggest transformation is happening digitally. ■



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