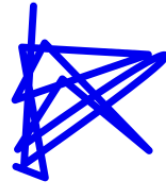




REPUBLIC OF ESTONIA  
GCIO OFFICE



KRATT  
Artificial Intelligence  
Programme of #eEstonia

# #KrattAI: the next stage of digital public services in #eEstonia

Vision and concept

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<sup>1</sup> The idea of #KrattAI was first proposed by Marten Kaevats, national digital advisor at Estonia's Government Office. He also nicknamed the concept as #Bürokratt in Estonian – a play of words from combination of terms *bureaucracy* and *kratt*, the adopted synonym of artificial intelligence in Estonia these days (originally, *kratt* was a creature in Estonian mythology). While a direct translation of #Bürokratt could be #AIofficial or #govbot, we chose #KrattAI as its English equivalent as the more generic term – to signal that the concept entails an ecosystem of AI applications aka *kratts*.

*Pille is just about to start enjoying her morning coffee when her smartphone awakens.*

*The virtual assistant Hedgehog<sup>2</sup> that came along with the phone's software, says in clear Estonian language: "Good morning, Pille! You have 10 new messages."*

*"Anything important and urgent?" Pille asks.*

*"Only one – a notice from Estonian Police and Border Guard. Your passport will expire in 6 months."*

*"Oh, then there's time still – Hedgehog, put a reminder in my calendar one month ahead of the deadline to renew my passport," commands Pille.*

*"OK. But last week you bought plane tickets to Thailand for next month. You need to have your passport valid for 6 months ahead to enter the country, based on the website of Ministry of Foreign Affairs," explains Hedgehog. "Shall I order a new passport?"*

*"Yes, Hedgehog – order me a new passport," commands Pille again.*

*"OK, I am making a connection to Police and Border Guard bot. You need to authenticate yourself to order – your fingerprint and secure code, please," asks Hedgehog.*

*Pille puts her finger on the phone's sensor and after beep says her secure code aloud. "OK, only one more thing – look into the camera, Pille," directs Hedgehog.*

*Pille does so and presses the selfie button. Passport picture is on its way and in just a matter of moments, Hedgehog speaks again: "Police and Border Guard bot asked to take another photo, as you should not smile on a passport photo. Look into the camera again, Pille." Woman does as ordered and new photo is sent away.*

*"OK, the passport will be sent to your home location within 5 working days," announces Hedgehog shortly.*

*"Our digital government is so nice and easy in Estonia here," thinks Pille and she has not even finished her morning coffee yet.*

## What Is #KrattAI?

It is first a vision of how public services should digitally work in the age of artificial intelligence (AI).

#KrattAI would entail an opportunity for people to use public direct<sup>3</sup> and informational services by voice-based interaction with AI-based virtual assistants.<sup>4</sup>

#KrattAI would not simply be an IT development project to create Estonian governmental virtual assistant aka AI-based interface to use public services –

<sup>2</sup> This is a mock working name for the virtual assistant in this paper, for the example to be vendor and device neutral. Hedgehog was a mythical smart advisor in Estonian national epic "Kalevipoeg" (see <https://en.wikipedia.org/wiki/Kalevipoeg>).

<sup>3</sup> Direct public services are the services provided by an authority to a natural person or a legal person in private law in accordance with the latter's will, including presumed will, via a service contact in any communication channel, enabling the person to perform an obligation deriving from law or exercise a right deriving from law – Government Regulation No. 88 "Principles for Managing Services and Governing Information", 25 May 2017, <https://www.riigiteataja.ee/en/eli/507072017004/consolide>

<sup>4</sup> A virtual assistant here-by is an interface programme/software that allows humans to direct devices to perform various actions with voice commands. Examples: Amazon Alexa, Apple Siri, Google Assistant, Microsoft Cortana, Samsung Bixby, etc.

although this might be necessary as an interim step. Instead, the concept of #KrattAI would allow people to get their governmental deeds done from any device and any majorly used virtual assistant in the future.

Thus, #KrattAI will be an interoperable network of public sector AI applications (agents, bots, assistants, etc) as well as private sector ones, which would work from the user perspective as a single, united channel for accessing public direct and informational services. Alternatively, you can call #KrattAI an ecosystem of interoperable AI applications to provide or access digital public services.

#KrattAI surely will not be one massive chatbot in a technological sense, handling all interactions and activities under its “belly” in one big application. Estonian digital government has been built on principles of distributed architecture set-up with the intent to make it more flexible for development and resilient against cyberthreats. This should be kept the same in AI age.

Should some AI application get broken, other AI bots and agents in the network have to be able to keep functioning for government to work and people to still get their government-related things done (even if partially). As AI is a fast-evolving technology, there will be a need to upgrade or replace applications all the time. If there would be only one big government-wide chatbot in place, the upgrades would be very costly and complicated without disruptions – as opposed to the network of tens (or more) AI applications, that can be upgraded and iterated in parallel faster, cheaper and more often.

## What problem is #KrattAI solving?

In short: to make digital public services radically easier to use and conveniently accessible for people.

People want public services to work in a way that:

- ... they would not have to make an effort or have or acquire special knowledge to use the services, neither because of the user interface nor service process quirks – they want to get things done as easy as possible and via user interfaces that are simple to use (including at all ages);
- ... services would work in whatever operation systems, software platforms, and devices – in a uniform way and with uniform quality, as much as possible.

Also, it is important that people:

- ... would not have to know themselves or spend time searching for information on which agency or website to turn to, in which order and what all will be necessary to receive the services to solve their need – people want services to be offered and delivered in an integrated manner, around their needs (e.g. life events) and at once;
- ... would not have to know or remember the deadlines of their obligations or opportunities (e.g. when to apply for benefits) – they want their government to notify them ahead of the deadline, i.e. offer services proactively;

- ... would still be able to make choices and select between service options in important moments and places – that everything would not be completely automatic.

It is obviously possible to improve the user experience of digital public services in these directions without AI. For example, that is why we in Government CIO Office have launched a programme of service redesign to make them integrated and proactive around life-events in Estonia.

Nevertheless, it is the great power of AI applications and tools to meet the described user needs and improve the user experience of public services significantly faster, better and more comprehensively.

That is exactly where AI-based voice-interactive virtual assistants are handy: with them, it will be possible to make the finding and delivering of services the easiest possible as far as interface is concerned. Voice is and will be the most natural, even intuitive way to use any services for almost any people.

The whole complexity and rigidity of the public sector can be moved to the background then, away from user to face and handle. It will be the full utilisation of power of interactions between software and machines that allow making services proactive, integrated, etc. The technology necessary for carrying out this vision largely already exists today, even if it requires somewhat further development and integration still.

Thus, #KrattAI is solving the problem of taking digital public services to the best possible user experience level.

Yet, there is one more reason for introducing the #KrattAI concept. The government of Estonia is already well on the way with active uptake of AI applications in various agencies and services.<sup>5</sup> We would better pay early attention to making these emerging AI applications interoperable with each other – so that different bots, agents, assistants etc would be able to function in unison to serve the users' needs.

Otherwise we will run a risk that large-scale uptake of AI will create new or amplify existing silos between government agencies or information systems. Users will have to handle then the maze of bots and virtual agents, finding them and knowing which one to use when – just like they have had to handle the maze of service portals and websites in the past. #KrattAI as an interoperable network of AI applications will allow to prevent this from happening.

## #KrattAI features – general business requirements

#KrattAI vision is that the users (private individuals or enterprises) would be able use Estonian digital public services in the following manner:

- ... by voice and in the Estonian language – government would not necessarily have to invest into other interfaces (web, app) anymore, at least not as much, and user experience would no longer be a factor of people's digital skills;

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<sup>5</sup> See Estonian national AI strategy at <https://www.kratid.ee/in-english>

- ... via whatever most common devices that come with virtual assistant functions – certainly it will not be possible for government to enable every possible device of every vendor, but we would have to achieve this for all of the most used devices, starting naturally from most common smartphones;
- ... service interactions will mostly be initiated from notifications aka proactive steps by the government, not waiting for users to find information and take the initiative themselves;
- ... users will still have a chance to initiate service interactions themselves, too, based on the relevant information services or otherwise – except in cases where service delivery has been fully automated for utmost user convenience;
- ... services and information would be personalised based on user's data, not just offer repetition of public information based on user's questions (as today's virtual assistants mostly work);
- ... users can authorise aka confirm different deeds and actions, e.g. submission of applications, making of payments or contracts, change of data in registries, etc. – which require (digital) signing otherwise;
- ... get his/her whole service need satisfied with one interaction at once aka all things taken care of in a (life-event) service bundle – the service offerings of different parts and levels of government (national and local) will be woven and delivered as a whole, same also will apply across the borders (in form of integrated cross-border services between governments) and across sectors (integrated services between private and public sector).

All of this vision will not be doable right away at once, but we can start experimenting with and implementing various requirements from this list one-by-one – building out the #KrattAI concept gradually.

## #KrattAI's technological requirements

Several technological challenges have to be solved to make the #KrattAI vision a reality:

- how to ensure voice recognition and synthesis in the Estonian language in the software of most common digital devices – the prerequisite here is further development of relevant base technology components and language resources for the Estonian language;
- development of a consent platform service – so that people could safely make the data that government holds about them available for third parties if they so choose to (e.g. for private sector AI applications or assistants);
- creation of a digital twin solution for people (e.g. based on eesti.ee platform) – this twin would hold the data on consents, interaction and other preferences for public services that people have made, as the basis for machine-to-machine interaction and queries (it would not entail all of people's data as a duplicate!);

- how to ensure the simultaneous functioning of #KrattAI as an interaction channel in virtual assistants and in web environment, at least at the beginning and at least for service availability risk management (to have back-up options available for any tech failures);
- what kind of interoperability framework, secure data exchange protocol and governance will be necessary to make various AI applications and virtual assistants function together and transparently (between government agencies, between private and public sector, also cross-border) – building from existing Estonian governmental interoperability framework and X-Road data exchange foundations, if possible;
- how to enable authentication based on Estonian national digital identity and authorisation with Estonian digital signatures in device’s virtual assistant sessions;
- adoption of event service architecture and orchestrators that would enable decoupling of bureaucratic proceedings and business processes from generic functions like notifications (sending of SMS or emails) and combine services into integrated (semi)automatic sequences.

In parallel, it would be useful to upgrade the technological set-up of the Estonian digital government: to transition to a more futureproof event-based microservice architecture, which better enables agile development and delivery of integrated services.<sup>6</sup>

A digital government built on interoperable AI applications will be in constant change mode, as bots or agents will be added and iterated, as personalised services will be quite different in detail for different persons, etc. This implies that AI applications as well as datasets and IT systems underlying them have to be ready for flexible combining and constant further development.

Therefore, it pays to start experimenting with and implementing in conjunction with #KrattAI introduction the following:

- microservice-based set-up of information systems: to ensure flexibility of development and fast scaling capability upon need;
- data exchange based on messaging room set-up, which could possibly in the future complement the Estonian current X-Road based data exchange (with a working title X-Room) – X-Road’s end-to-end aka synchronous connections may not sufficiently support parallel working of many AI applications at once (i.e. X-Road may not be fully scalable to AI age requirements).<sup>7</sup>

## Next steps to realize the #KrattAI vision

Government CIO Office (in Ministry of Economic Affairs and Communications of Republic of Estonia) will start working in 2020 towards realizing the #KrattAI vision, with the following actions:

<sup>6</sup> This and the proposals of the following paragraphs are longer explained in the forthcoming vision paper “Next-generation digital government architecture”, by Kristo Vaher, the chief technology officer at Government CIO Office, Estonia.

<sup>7</sup> See more on X-Road at <https://e-estonia.com/solutions/interoperability-services/x-road/>

- Selecting the preliminary use-use for #KrattAI pilot project, to start trying out how to solve the core technological and business requirements – 2<sup>nd</sup> quarter;
- Carrying out the #KrattAI pilot project for developing a proof-of-concept and identifying technological alternatives – 3<sup>rd</sup> quarter;
- Preparing the roadmap for full #KrattAI concept build-out, taking into account lessons from pilot project, discussions with stakeholders and experts, etc – 4<sup>th</sup> quarter;
- Agreeing the collaboration activities with Finnish government (Ministry of Finance there) to try out and develop cross-border interoperability of AI applications. Finnish government has launched a programme AuroraAI, which is very similar to #KrattAI concept.<sup>8</sup> It has been a digital policy priority for both governments to connect digital services and data bilaterally between the governments, and here-by such collaboration would be extended to AI age by connecting the AI applications with each other.

Any ideas or feedback to this vision paper is welcome at email [kratt@mkm.ee](mailto:kratt@mkm.ee) – this is also the point of contact for further information requests on #KrattAI.

Overview of #KrattAI implementation will be there at website [www.kratid.ee/in-english](http://www.kratid.ee/in-english) in the future, too.

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<sup>8</sup> See on AuroraAI: <https://vm.fi/en/auroraai-en>