Architecting a country

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Agenda

- Fundamental concepts
- Country background
- Problem statement: what are we solving here?
- E-government meta-architecture
- Application of the architecture in Estonia
Fundamental Concepts

Emergence

Cost

Profit/efficiency

Value

Concept

Form

Function
Country background: Estonia

A small open economy in Northern Europe
## Some perspective

<table>
<thead>
<tr>
<th></th>
<th>Population</th>
<th>Surface area</th>
<th>Population density</th>
<th>PPP gross national income per capita</th>
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<tbody>
<tr>
<td>Estonia</td>
<td>1</td>
<td>45</td>
<td>31</td>
<td>23,280</td>
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<tr>
<td>Latvia</td>
<td>2</td>
<td>64</td>
<td>33</td>
<td>21,820</td>
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<td>Russian Federation</td>
<td>144</td>
<td>17,098</td>
<td>9</td>
<td>22,800</td>
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<tr>
<td>Singapore</td>
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<td>1</td>
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<td>United States</td>
<td>314</td>
<td>9,832</td>
<td>34</td>
<td>52,610</td>
</tr>
</tbody>
</table>

1 - In millions, rounded to 1
2 - In sq. km thousands
3 - people per sq. km
How to run a country with a small scattered population, tiny economy and no natural resources?

For the past 20 years, Estonia has chosen focusing on e-government
E-government problem statement

- A need to provide increasingly complex services in an increasingly complex world
  - Systematic development of functional architecture requires a structured understanding of the technical architecture

- Impact of e-government on democracy
  - Predicting emergence assumes a well-developed understanding of the technical architecture

- Cost-reduction without damaging business alignment
  - Thoughtful consolidation of services is a platform problem that assumes a robust technical architecture
Architecture of an architecture framework

What does a framework for describing technical architecture look like in a loosely coupled organization?
Meta-architecture. Function

- Provide a holistic view covering the entire system in question
- Apply in a wide variety of international settings
- Have a right level of abstraction allowing for addition or removal of detail as need be
- Be usable as a communication tool for non-technical decision-makers
Meta-architecture. Concept

• How to relate the technical architecture to an unknown functional architecture?
  • The framework must be compatible with a wide range of differences between countries and be able to respond to democratic change

• Establish a set of defining functional issues which the technical decisions depend on

• Three main axes to focus the questions
  • Centralization. How centralized is the system in question?
  • Privacy & security. What are the relevant security- and privacy policies?
  • Diversity. What is the level of diversity in the solution space?
Meta-architecture. Form

- **Citizens/Officials/Enterprises**: Denoting the main focus of the framework.
- **Electronic identity**: The layers used to split the underlying architecture into manageable, technologically uniform parts.
- **Delivery channels**
- **Integration**
- **Infrastructure**
  - **Agency**
  - **Agency**
  - **Agency**
  - **Agency**

Agencies as containers for the individual information systems.
The e-governance technical architecture framework

What is it that we ended up building and using?
The electronic identity layer

- E-government services require a way to relate citizens to their portfolio of rights and obligations
- The questions
  - Who is the target customer? I.e. What can be assumed about the user?
  - What is the legal significance of electronic identification? Higher significance requires a more robust technical solution
  - What is the multiplicity relationship between legal and electronic identities? A citizen could have several electronic identities and shared electronic IDs could be conceived
The delivery channels layer

• A distinct set of solutions providing electronic access to the information systems of the agencies

• The questions
  • What is the diversity of channels across the services? I.e. what channels a particular service tends to be provided on?
  • What is the diversity of channels across the country? I.e. what is the total set of channels all the services make use of?
The integration layer

- The integration layer joins the information systems of different agencies allowing for sharing of data and functionality

The questions

- To what extent are services centralized between the agencies? Effectively, what is the feasibility of a centralized middleware solution?

- What are the integration paradigms (e.g. document, data or service) used? This has a strong impact on the functionality of the middleware solution used.

- How are privacy and data ownership regulated? Integration layer is a central point for any privacy policy implementation
The infrastructure layer

• All of the software described in previous layers needs servers and network infrastructure

• The questions
  • How tightly is the infrastructure consolidated? This question is mainly about physical infrastructure and networks
  • To what extent are platforms offered centrally? I.e. what is the cloud strategy in place?
  • What restrictions exist for the physical location of data? I.e. to what extent can off-shore infrastructure and platforms be used?
Technical architecture of Estonia

Using the framework to describe the technical architecture of Estonian e-government
Estonia. The electronic identity layer

- PKI based on a smart-card picture ID
  - A SIM card can be used as a secondary token
  - For authentication, federated bank-based authentication schemes can be used

- The card is tied to a unique ID code of a person
  - There is little information on the card but that code

- Digital signature is legally equivalent to the physical one
  - 2-3 digital signatures per capita given per month
Estonia. The delivery channels layer

- Web is the main service delivery channel for most widely used services
  - Mobile is not there yet
  - Branches are used for tailored or complex services
- In 2011, 94% of personal tax returns were filed via a web-based portal
- 120+ different contact points exist, centralization is low
  - Although a central service portal, eesti.ee, exists
Estonia. The integration layer

- A distributed enterprise service bus called x-road is used
  - Offers authentication of parties and secure transport
  - Communication happens peer to peer
- Use of x-road is compulsory for any intra-agency communication
- A central service discovery portal exists
  - Registration of any public information system is compulsory
Estonia. The infrastructure layer

- The infrastructure is mostly disperse
  - Albeit most government networks having been consolidated
  - There is a large number of tiny hosting facilities with varying levels of quality

- There is a readiness and a plan to move towards central platform offering
  - Most agencies use virtualization extensively
  - A common set of non-functional requirements towards new systems is in place
Thank you!

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