

Why government has to reclaim work processes

By Per Tejs Knudsen, CEO cBrain, November 2019

Processes first, technology second. Danish public-private partnership and longtime research have fostered a groundbreaking approach to government digitization based on formalized methods and standards. Digitizing all types of work processes and services, from internal to citizen facing, it is based on executable process libraries and a new combined process-driven and data-centric software architecture designed for digital bureaucracy.

Advanced analytics, blockchain, cloud first, robotics, artificial intelligence, and open source; across the world, government continues to apply new technology and new technology based strategies to transform themselves, digitize, and automate citizen services. Yet, as new technologies have emerged and left, government has been struggling for decades and still does struggle to convert ambitious digitization plans into deliverables and measurable results.

Originated in Denmark and proven in a number of countries across EMEA, a new approach to digitization offers government fast track digitization and strong measurable effects. It is based on a formalized model for government production, referred to as “digital bureaucracy”, and supported by a new type of standard software and a highly structured implementation method.

Government production is based on bureaucracy. Yet, as the classic bureaucracy is now challenged by a shift from paper-based to digitized information, this shift also offers transparency, significant productivity gains, and more efficient service delivery.

While technology continues to change, government means and duties remain. Technology trends and a limited understanding of how government works often hinders digitization. Further this often results in technology based business transformations where technology itself becomes the goal.

Rather than investigating new technology, the offset for the new approach to digitization was studying the processes and resources enabling government service delivery, as well as understanding the nature of government work and the bureaucracy. This led to a generic model for government work based on best practices independent of technology, named “digital bureaucracy”.

With the generic model, next step was to design and build a configurable production system, which could be configured to support individual authorities. This was accompanied by a deployment method to guide the design of specific internal and citizen facing processes, and to guide the internal organizational implementation.

The research made it clear that government has to reclaim the ownership and insight into work processes, which during the last decades has been buried with IT systems, often controlled by external experts and suppliers. In the same way, government must be in control of organization and the responsibility for service delivery.

Modeling government work. A new approach to digitization

More than 10 years of research has sought to understand the nature of government work: With mathematical roots from the Technical University of Copenhagen and based on a public-private partnership with Danish government, the private company cBrain has developed a generic model, a formalized description method as well as a new type standard software. It is based on a new process-driven and datacentric software architecture - a production system for the digital bureaucracy.

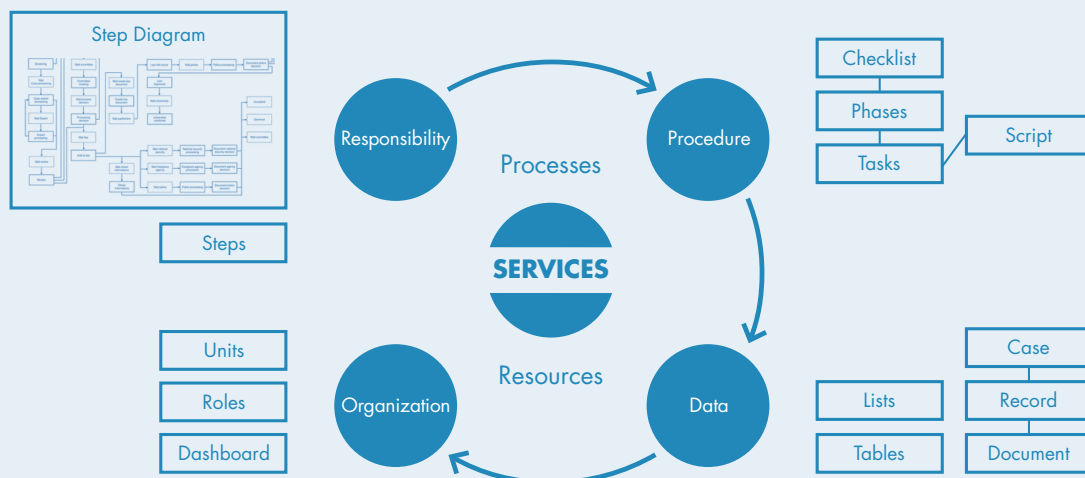
The digital bureaucracy model has historic roots to German philosopher Max Weber and the classic paper based bureaucracy. A government organization is seen as a production unit authorized with the legitimate right and responsibility to exercise a specific set of services (duties) on behalf of the society. Any service has a corresponding set of work processes, which formally defines how the service is delivered.

- For any service the organization has the duty to administrate and execute a number of decisions, the legitimate right. A government authority can thereby be defined by the set of decisions which it administrates. Based on a best practice single case principle, each unique decision is linked to a specific case type, executed and administrated by a case type specific process and resources.
- The process description is generic and defines service delivery by four dimensions; the work progress defined by steps, tasks describing standing operating procedure for each step (leading to a checklist), information used and produced (data), and organization linking responsible units to tasks.
- The description method is independent of any technology and does not use IT terminology. It simply offers users a structured approach to describe governmental work, using government terminology based on government best practice principles.

Introducing the F2 model and design method for digital bureaucracy

A government authority has the legitimate right and responsibility to deliver a set of services, which parallels a set of decisions that the authority has the right to exercise and administrate. Decisions therefore becomes the index of the authority library of standard operating procedures (SOP).

The digital bureaucracy model is based on a single case principle, where any unique type of decision has a corresponding case type. For any case type, work is modeled/described by processes and resources, and organized into four dimensions, responsibility, procedure, data, and organization.



Firstly, the work progress is described in steps, leading into a so-called **step diagram**. Reflecting the rhythm of case processing, there are two types of steps; waiting steps and in-progress steps. This dimension is called "Responsibility" as work progress is controlled by assigning responsibility to each step, waiting steps as well as in-progress steps.

Secondly, for each in-progress step, the **tasks** related to the each step in the step diagram are described. Tasks are logically organized into phases, e.g. screening, evaluation, and executing a decision, which constitutes a decision checklist. As work progresses, step-by-step, and tasks are performed, the checklist is filled out, leading to a decision while controlling the decision execution. The second dimension is therefore called "Procedure", as the checklist models the standard operating procedure.

Thirdly, for each task, **data** requirements are described. This includes all information (data) needed to perform the task as well as all data produced as a result of performing the task. Production data are organized as records with documents, organized chronologically into a folder, the case, supported by base data, called tables, and presented to users by lists.

Fourthly, the description circle ends by describing responsible units and roles for each step, which supports production reporting by dashboard etc. This dimension is therefore called **Organization**.

With the model and description method it is possible to build a library, which formally describes the specific responsibility and work processes for a government organization, indexed by decisions and described without any connection to technology.

From IT-centric to business-centric. While delivering measurable effects.

The processes first approach does not only allow government to reclaim and take back the control of work processes. It also enables a new fast track approach to digitization. Based on standards and configurable standard software, the approach reduces digitization projects by factors. While minimizing risks and reducing costs, it changes digitization projects from being IT-centric to business-centric.

Reclaiming control is managed in two steps. Firstly, one regains control of work description, as this is now independent of systems. Secondly, one regains control of production systems. As the description is formal, i.e. based on mathematics and thereby readable by software, government can now demand vendors to deliver software that can interpret and execute the process description. Thereby, government no longer loses control while it acquires, rewrites, and integrates software components in order to digitize and support work processes.

The formal process description constitutes a standard, a foundation and enabler for developing standard software. Reclaiming control of work processes based on standards therefore enables government to shift from using custom build into using standard software.

Realizing that government organizations generically works the same way, being able to model this and thereby shift from custom build to standard software is groundbreaking. It changes software acquisition, speed of delivery as well as software efficiency, quality, and performance. It changes organizational implementation, and perhaps most importantly also impact user acceptance.

As the new model based approach to digitization is proven and accepted, this may lead to rethinking government IT and it may initiate a industry shakeout across government technology vendors and consultancy firms. Similar to the industry shakeout which many private industry verticals have envisioned as they moved from custom build to standard software.

Proven in Denmark and a number of EMEA countries, digitization based on standards delivers measurable effects. The United Nations E-government survey ranks Denmark as number one. Key success factors to reach the number one E-government position are standards and public-private collaboration, cBrain being one of the partners.

Today, more than 50 Danish government organizations base their operations on the cBrain standard model and standard software for digital bureaucracy, called F2.

The model and software have been implemented at 2/3 of all ministerial departments, including the Prime ministers office, the Ministry of Foreign Affairs and the Ministry of Taxation. The Ministry of Finance has implemented F2 for the complete enterprise, department as well as all agencies. In 2017, the Danish State administration, who serves more than one million citizens, won the national digitization award for best citizen services, while reporting significantly increased productivity and cost savings as well as significantly increased employee satisfaction.

Denmark is not special with respect to government duties and services. Government across the world basically operates based on the same bureaucracy foundation. Denmark differentiates due to longterm national strategies like standards, public-private partnership, and an approach based on business first, technology second. Even though Denmark has minor national IT budgets compared to large countries, the Danish strategies has optimized IT investments and leveraged a globally leading position when it comes to E-government.

The digital bureaucracy model forced software innovation. The processes first approach led to the model for government production, independent of technology. As a next step, technology and software was requested to deliver a digital platform to support government production in line with the model.

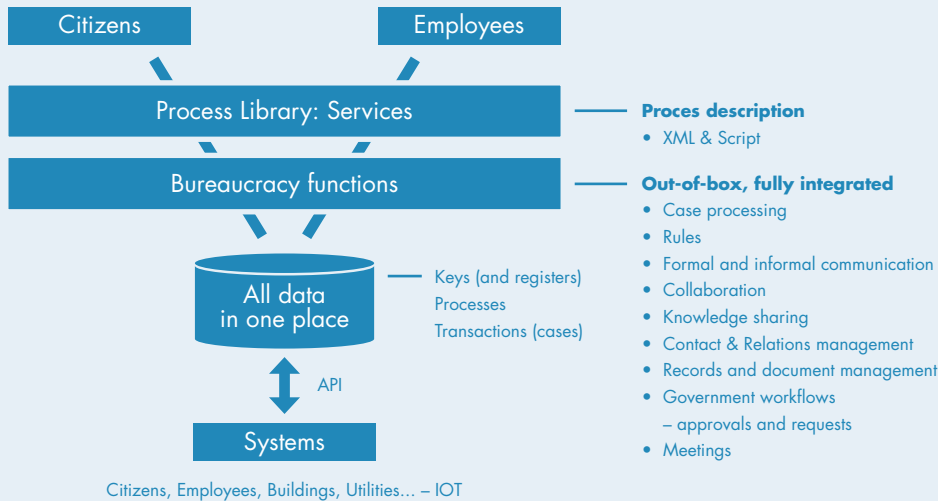
This led to a new and fully integrated software architecture and a software application stack consisting of four core elements:

- A centrally shared data repository holding all relevant data across different case types including transactions (organized into cases), work process descriptions (indexed by case types and versions), and key/base registers holding process independent data and tables (e.g. citizens and users).
- A library of (atomic) user action components, supporting the core set of user functions which are used for government work, from functions related to formal and informal communication and generic government processes, such as approvals and requests, to filing, FOIA requests and compliance (e.g. records management and GDPR).
- An executable process library organized by case types, where a process can be linked to a specific (named) case, when a case is activated, then controlling and supporting the case progress, decision making, use and production of data, as well as interaction with organizational units and user roles/users.
- A set of open API-driven user interfaces, enabling multi channel access, multiple user interfaces (smart client, thin client web based, App based etc), as well as standardized interfaces (based on open RESTAPI, s) to communicate with external government and private services, legacy systems, etc.

The F2 software stack, supporting the digital bureaucracy model

Historically, government software architectures are often based on multiple point solutions, each supporting specific functional areas (such as BPM, case management, records management, self-service frontend/CMS, e-mail based communication, social media, collaboration, and BI), running in an enterprise architecture, integrated e.g. by use of service bus, and work orchestrated by work flow engines.

In contrast, the F2 software architecture is based on a single fully integrated software stack, designed to support the digital bureaucracy model, where users work out of cases, and corporate data are separated from processes to control access and re-use data across work processes and organizational units.



All relevant data are stored in a shared central data repository. Keys (e.g. employee, unit, citizen, building, etc.) with tables/registers store base information used across processes. Process declarations, indexed by case type, store work definitions as well as all footprints related to process execution. All transactions are stored, organized by cases, holding records with documents. All data can be exchanged and exposed by an open (REST-API based) set of interfaces.

The bureaucracy functions is a components library, which offers all user actions, defined as atomic functions (e.g. send record, respond to request, and submit approval), which can be activated individually or as part of a process. The set of user actions reflect relevant functionality across traditional software categories, all-in-one library.

The process layer executes process definitions, activated when individual cases are linked to a case type, and driven by steps linked to user actions and lists. User actions support multiple interfaces, internal users (employees) as well as external users (e.g. citizens, companies or other authorities that interact via processes).

Taking government work as the starting point, the fully integrated software stack has been designed to comply with and support the digital bureaucracy model.

The model led to a data-centric and process-driven architecture. By combining data control and transparency with efficient user process support, including quality support and work automation, the software architecture offers significant advantages.

- In line with the classical bureaucracy best practices, all information including formal as well as informal communication are stored in a shared central data repository (the “files/archives”), organized as records in chronological order within cases. As records and documents are born within cases and users “work and communicate out of the cases”, all relevant information is stored properly without any further user interaction, and the nightmare of individual mailboxes have been eliminated.
- Efficient reuse of data is possible, because all data are stored based on a normalized data model, covering all case types. This is possible, because metadata has been divided into 3 types:
 - generic mandatory i.e. case number, title, and creation date
 - generic optional e.g. citizen ID, which is relevant for citizen facing processes, status codes and deadlines
 - case type specific metadata, which and extensions and normally only relevant for one or a few case types
- The separation of data and processes enables efficient access control. It is not possible to apply access to data, as access to data depends on context. Data access is now offered and controlled by roles, related to specific work process steps (as defined by the step diagram). Furthermore, data can be re-used across processes, thereby enabling a very simple method for data re-use and process automation.
- The model offers a highly efficient approach to work automation without compromising compliance, security, documentation, etc. Without changing case flow (steps) or decisions (checklist), tasks, i.e. the work related to a specific step in the step diagram, can be automated by use of relevant techniques, including robotics and AI. The model thereby directly supports context based optimization and automation.
- A process itself can be optimized or reengineered by changing process declaration. Like optimizing case progress by adding and/or changing steps, or changing decision making, e.g. due to change of law, by changing checklist rules. This includes process and checklist variances. A step diagram may offer e.g. different routes of steps controlled by individual case metadata. Likewise, decisions may vary controlled by individual case metadata.
- The data repository holds versioned declarations of processes. This allow for A and B testing, e.g. testing process optimization and automation for a selection of cases or a smaller organizational unit before deploying full scale.
- The data repository also holds all footprints related to process execution, directly linked to the process transactions (cases, records etc).

Supporting digital readiness and strategy based on process portfolio view

With a generic model for digital bureaucracy and new software architecture, designed to support government production, the third element is implementation which includes process design and setup as well as organizational deployment.

The step diagramming method for process design is accompanied by a toolset for onboarding processes into the process library. A process description is onboarded as a declaration, by use of a formal process specification language, which is interpreted by a process execution engine. In parallel, the onboarding work is supported by a dedicated toolchain, which, supports highly automated staging, devops, quality control, etc. by utilizing that the software is completely standardized.

Introducing the digital bureaucracy model and software drives change. Organizational implementation is therefore based on implementation waves, based on best practices while taking organizational readiness into account.

The digital bureaucracy model is based government best practices, directly supported by functionality, built into the standard software. With the wave model, organizational implementation is orchestrated by deploying best practices and functionality aligned with organizational change. This is possible because set up of the standard software, base functionality set up as well as process declarations, is based on configuration.

The wave model is based on 3 elements: a set of overall best practice principles, deployment of generic routines and driving (often departmental) process digitization based on case types. Each element targeting different organizational management groups.

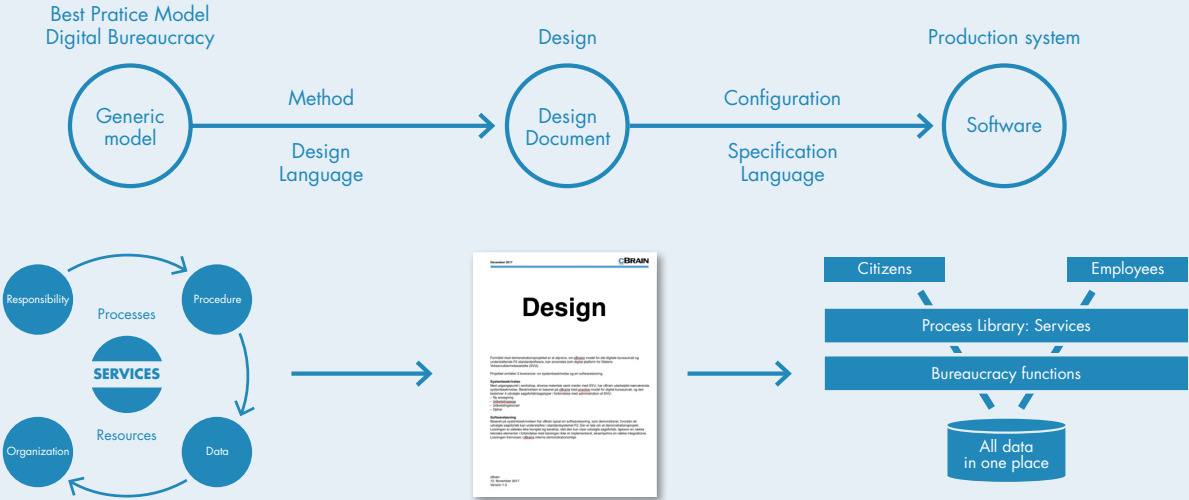
- The offset for overall principles is a cookbook of best practice suggestions and experiences, which is independent of technology. Principles are discussed and agreed with senior management, which set the overall stage for digital ambitions, short and longterm, as well as the speed of change.
- Guided by the overall principles, deployment of generic routines and functionality are discussed and agreed with program and IT management, leading to a specific “wave scheme” which directs both an organizational (business) project plan and a technical project plan.
- Individual processes are digitized based on organizational readiness, at unit level, discussed and agreed with functional/unit leaders. The set of services, related to any authority, can be divided into external services, defined by the given legitimate responsibility, and internal services, defined by the authority itself to operate (e.g. HR processes). Operational responsibility for each service is normally delegated and authorized to specific organizational units. Process digitization is therefore based on identifying processes within each department, i.e. building an individual library of case types for each unit, while agreeing the speed of digitization.

By continuously adjusting the production system in parallel with organizational change, user acceptance is increased and organizational friction reduced.

Onboarding processes

Processes are designed based on the best practice model for digital bureaucracy, by use of the step diagramming design methodology. Process design is independent of technology. It starts with identifying decisions and corresponding case types and delivers a design document, which describes work in business terms for each case type/decision.

The design document is translated into a formal specification, which is stored in a process library and executed by the standard software. The specification language offers extensive scripting capabilities and is open which allows e.g. for calling external services, such as integration to other government services or AI routines and robotics.



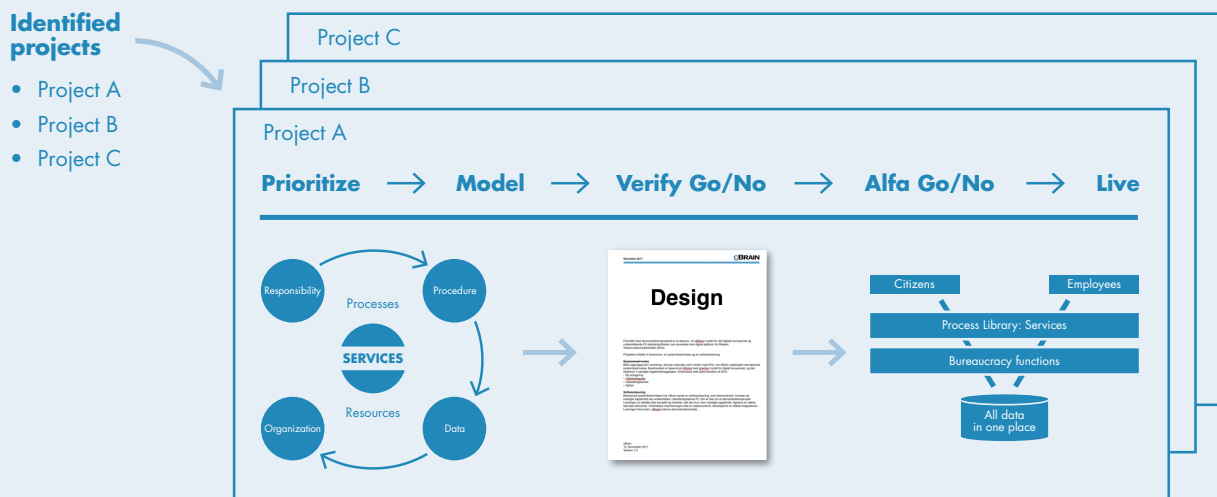
Digitizing individual processes, aligned with functional/unit management and taking organizational readiness into account, offers executive management the strategic opportunity to base digitization on a portfolio-driven approach. Prioritizing and aligning digitization across the organization, while optimizing internal resources for support.

Furthermore, the combination of digitization based on standards and the portfolio-driven approach allows IT and process specialist management to develop competences and internal best practice and specialist organization, enabling accelerated agile digital transformation and supporting individual organizational units across the enterprise, while coordinating and securing the ownership and insight into work processes.

Enterprise portfolio management, supporting business-driven transformation strategy at enterprise level

Units identify and suggest areas of digitization, process by process, thereby building an enterprise portfolio overview into potential digitization.

Projects are prioritized and selected for initial modeling. Designs are verified, evaluated, and approved for next step, which leads to an alpha version of a new digitized process. Based in go/no-go, the process is finalized and implemented to go live.



The banana model. Agile process tuning and reengineering

User acceptance is often a key challenge when introducing new systems. Frictions to individual user acceptance may be many, varying from employee habits to bad design or bad engineered software.

Learnings from multiple implementations show that trying to introduce a new system, which by nature is a challenge, while at the same time introducing radical changes to work processes, make it difficult for most users to adapt. However, this is the reality with most classic IT projects.

The new model based approach can ease the user adaption by first “meeting the user”, and then changing work processes at a speed directed by user acceptance and adaption.

This is possible, as process descriptions, modeling case types, and related work are declared and onboarded to the process library. It is therefore easy to change and adjust processes, and thereby the production system.

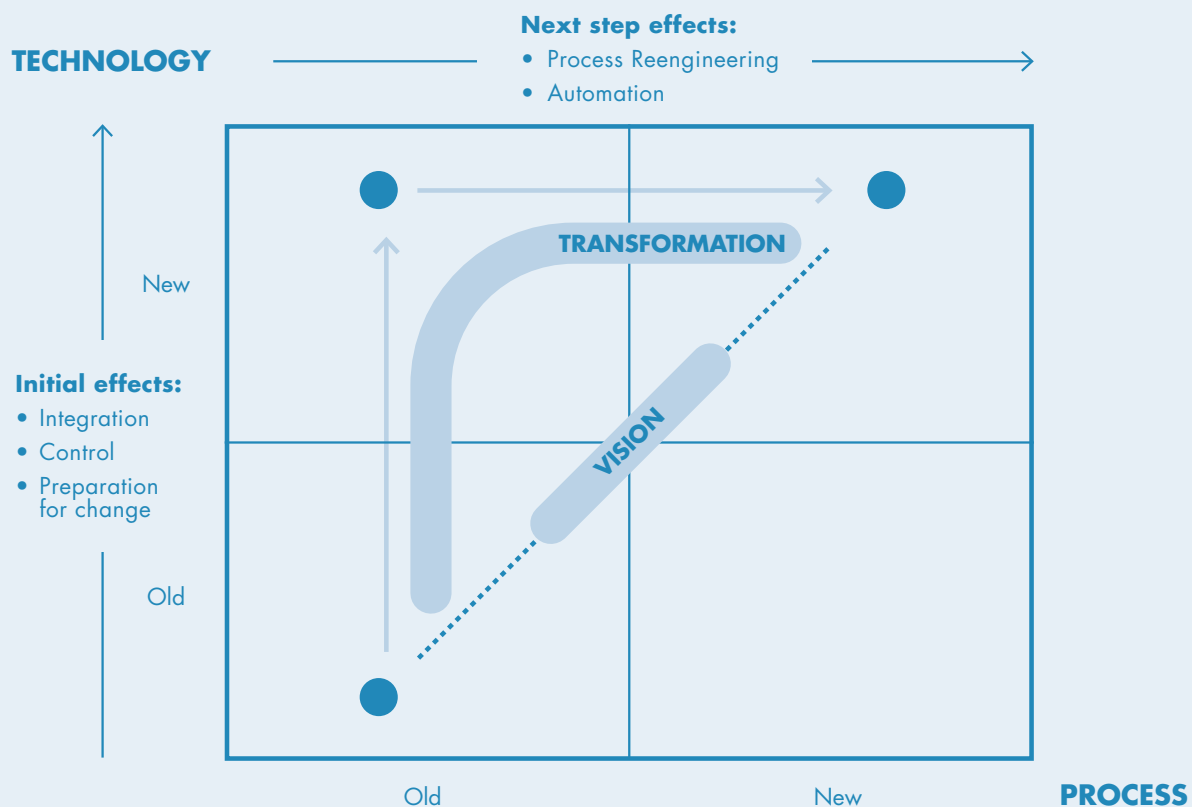
This can be utilized to minimize user acceptance frictions through an agile approach to process reengineering and optimization by firstly digitizing processes, supporting users in how they work today and thereby minimize changes to work routines and habits. Afterwards, adjusting and tuning work processes are done in smaller steps at a speed which users and the organization can follow and adapt.

The Banana model. Agile implementation

Acquiring new systems is normally driven by two dimensions; a simultaneous request for new technology and new processes. This causes IT projects to fail for two reasons, referred to as the “work place gab” and the “future work gab”.

- Changing technology and processes at the same time often represents a major jump, which is difficult for most users to understand and adapt to at the same time. When this two-dimensional alignment gab, old-new technology in parallel with old-new work processes, hits the user, it creates frictions.
- New processes are difficult to design. Interviewing users and analyzing existing work processes very often leads to a requirements list of routines to fix rather than a blue print for future work. This, because employees and management often can only explain “what is not working today”, while defining new processes are more difficult. Often it is not even clear, how the organization work today. A gab between what we know today and what we need to know about future work processes in order to design.

The model based approach, based on process declarations, supports an agile implementation method, which addresses the gabs.



First processes are designed with the **aim to support how users work today**. This significantly eliminates the work place gab, as users can “recognize themselves”. Designing is based on diagramming in close collaboration with users, and with the offset in current processes.

However, presented with a step diagram, which very clearly illustrates how work is done today, users often suggest changes themselves. Almost kind of jiu jitsu, as users now take charge and want to change. These first user driven adjustment to processes mean that even first version of processes are optimized, described by the curved transformation line with the nick name the “banana curve”.

Next, after going live, work is now observed. This allow for next wave tuning and reengineering of processes, simply implemented by changing and updating process declarations within the process library. Now, further optimization and the future of processes are designed by user experiences, which minimizes the future work gab.

Due to lack of software flexibility, most IT projects change processes and technology at the same time, which is a major jump, leading to work place gab, which in parallel with the future work gab leads to failing projects. This is named “Vision” in the banana model.

Appendix 1: Project examples

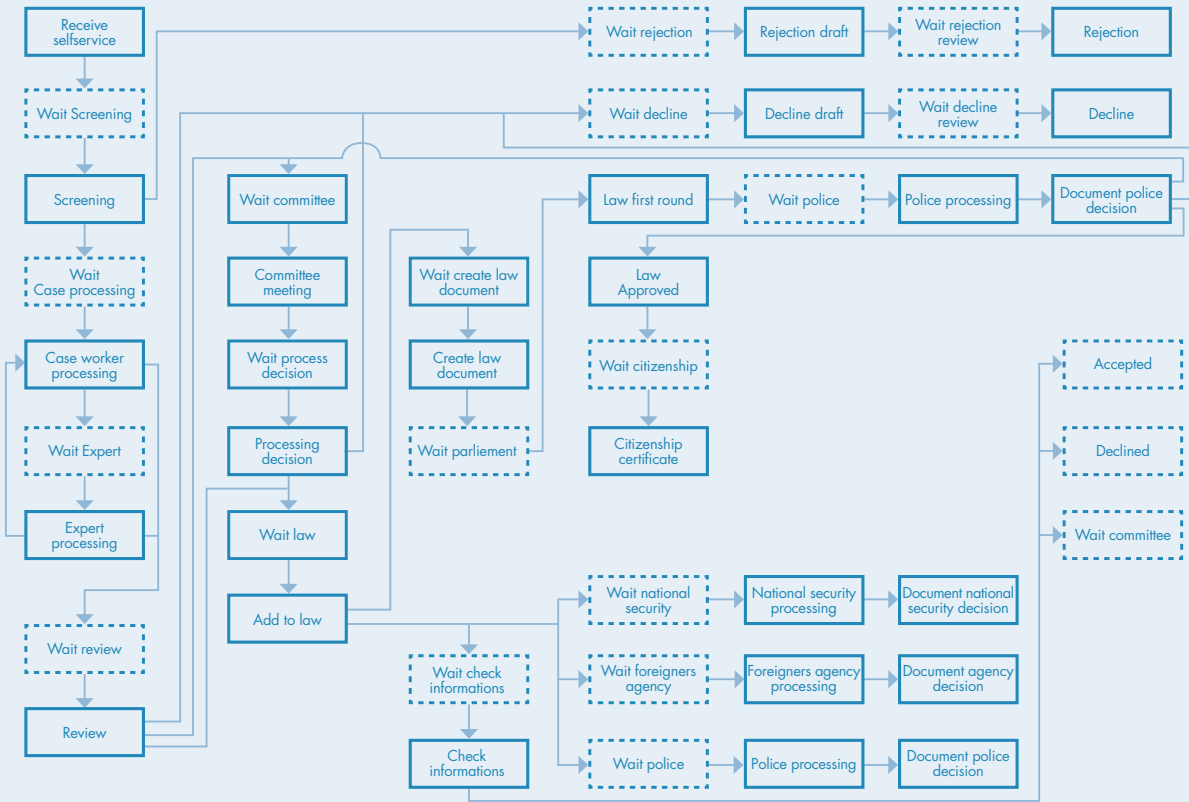
Danish citizenship. Mission critical solution for The Danish Ministry of Immigration and Integration, digitizing the internal work processes controlling the internal government work to become Danish citizen.

The solution was designed by use of the step diagramming method. This includes several types of variances, e.g. related to origins of applicant, handling of individual cases for children, extensive checklists, and communication with several other authorities. As part of the work process the solution generates a law document for the Danish parliament, as well as reading and updating the national citizen register.

The step diagram was annotated, adding tasks and data requirements for each step, and the final specification was onboarded as a process configuration to the process library, tested and successfully went live.

Example of step diagram: Danish citizenship back office process

A step diagram consists of a number of work steps, divided into two types; waiting steps (dotted line box) and inprogress steps (full line box).



The back office processing receives a request for citizenship (national web site). The request is screened, then either rejected or processed.

Following the initial case work, the request will either be declined, submitted for special committee handling, or accepted, then waiting for next law. Groups of accepted requests are bundled for law, typically 2.000-3.000 new citizens at a time.

A law is generated and send to Parliament for approval, and when approved, each case/request is updated, including updating national citizen register with citizen status and issuing citizenship.

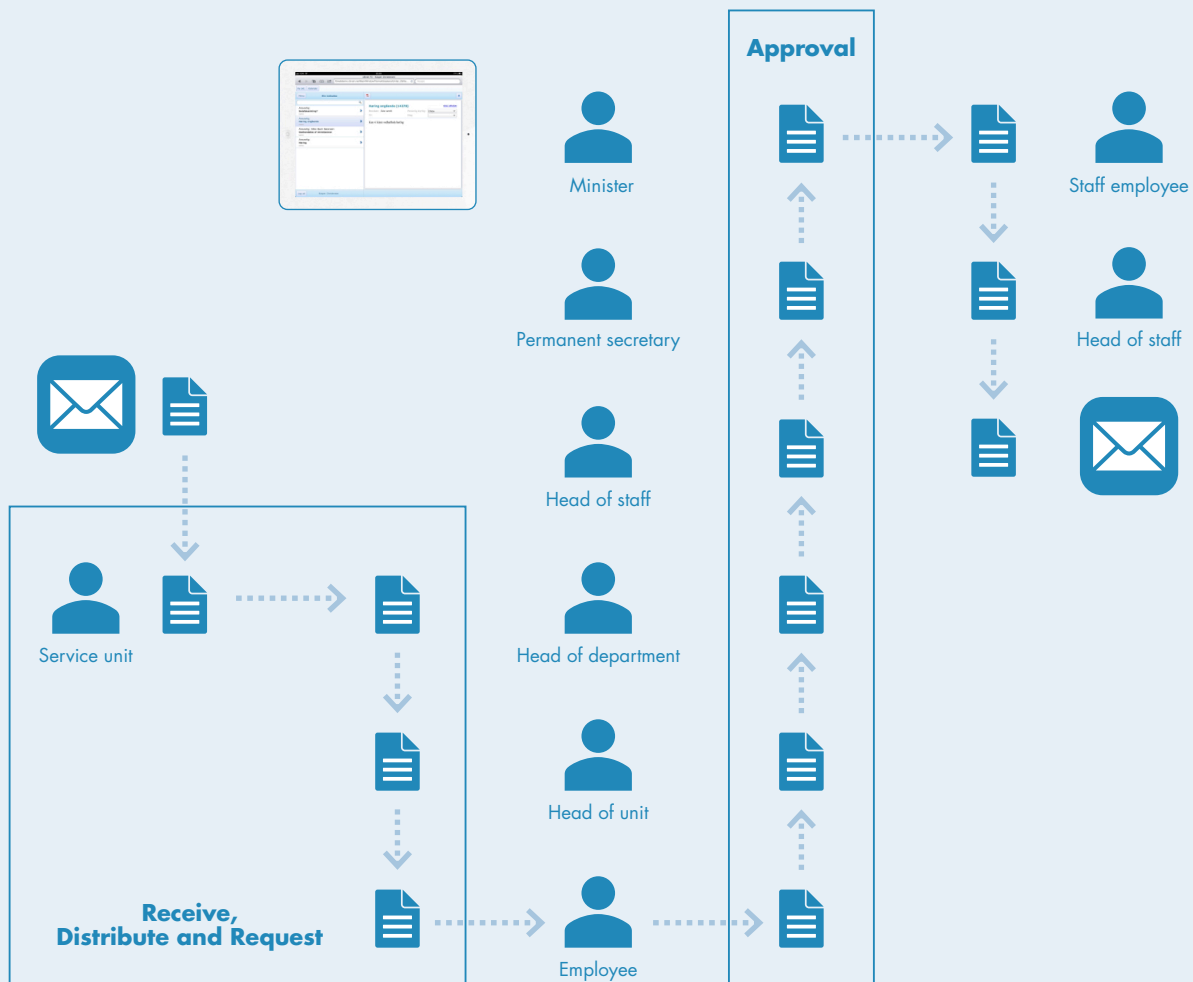
In parallel, many types of checks are performed, including exchange of information with national security authorities, police, and foreign affairs.

Supporting end-to-end work processes related to citizenship is clearly a complex solution, and the project was kicked off without a traditional system requirement specification phase. Still, the solution was delivered during an 8-months calendar period from project kickoff to go-live, covering design (based on the step diagramming method), specification and configuration, setting up integrations and installation in a secure government infrastructure as well as testing, organizational implementation, and go-live.

Departmental solution. Today, 2/3 of all the Danish ministerial departments base their internal work on F2, from Prime ministers office to Ministry of Foreign Affairs, Ministry of Finance and Ministry of Tax.

F2 supports out-of-the-box all work based on a single fully integrated solution including areas like correspondence management, formal/informal communication, case and document management, knowledge management, meetings as well as records management and filing. This includes working on PC in parallel with mobile.

Example. Department work flow, supported by F2



The service unit receives an inquiry. The inquiry is distributed via department to unit and employee. The employee prepares response, which is approved via steps to permanent secretary and minister, who comment/approve either on PC or mobile/iPad. Staff finalizes and sends response. The complete process and all functions, including filing/records management, are supported by the F2.