Architectural Overview

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Content

Executive summary

The Architecture Overview is meant to be a high-level presentation of the necessary architectural building blocks and enablers to support the Nordic Smart Government interoperable ecosystem.

This overview is formulated to bind the more detailed architectural documents together and derived from identified architectural capabilities.

The overview focuses on the collection of application services that organizations share as a set of common goals and collaborate to provide specific services to customers regardless of the technology ownership or operational models and geographical distribution.

All the proposed architectures relies on well-known technologies (APIs, message exchange, addressing). This means that the NSG-vision can be implemented using these existing, well-known technologies. This does not, however, exclude that the future implementation-phase can take advantage of other technologies, for instance Distributed Ledger Technology (DLT).

The Nordic Smart Government ecosystem

The realization of Nordic Smart Government through an interoperable ecosystem of digital solutions will provide real-time financial data for business-to-business and business-to-government interactions. It will consist of public and private systems handling financial data used by the SME:s in various business systems. Business administration such as transaction processing and reporting to governmental authorities is supported by the ecosystem, as well as access to financial information for business counterparties.

Nordic Smart
Goverment

Goverment
agencies

Operators

SME's
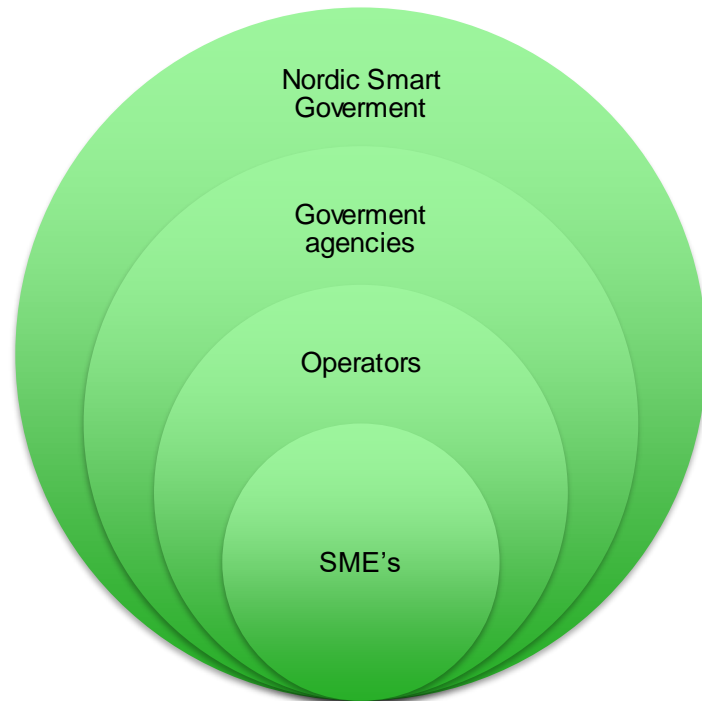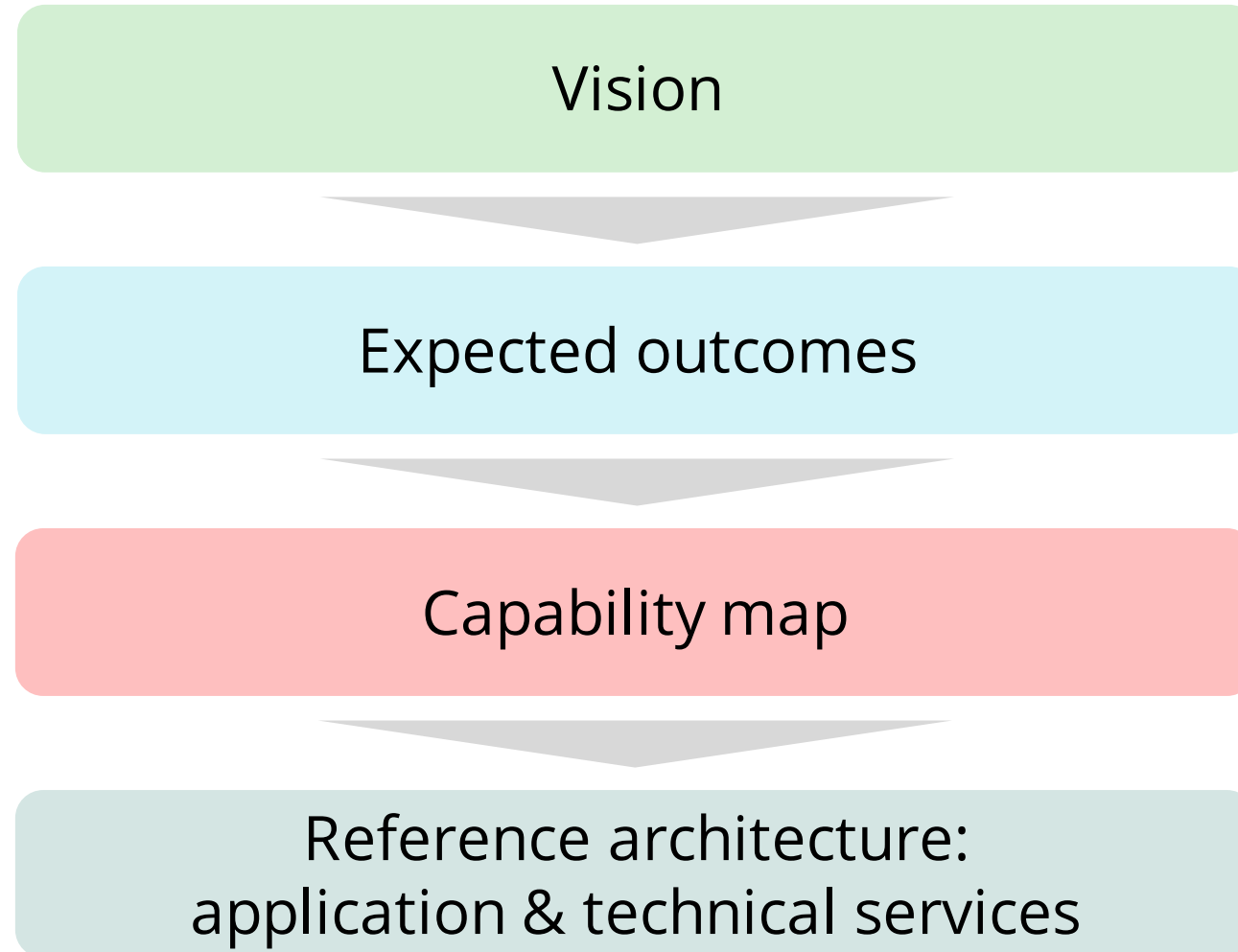
Recognized counterparties:

SME is any entity that engages in business transactions and is required to report it's financial data to Government agencies. (We use SME the entity as those are the main target group for NSG, although the architecture will be relevant for larger companies also.)

Operators deliver information between businesses or to Goverment agencies and are part of standardised data supply chain.

Goverment agencies analyse the business entities data and are resposible for the Economic and financial regulation fulfillment.
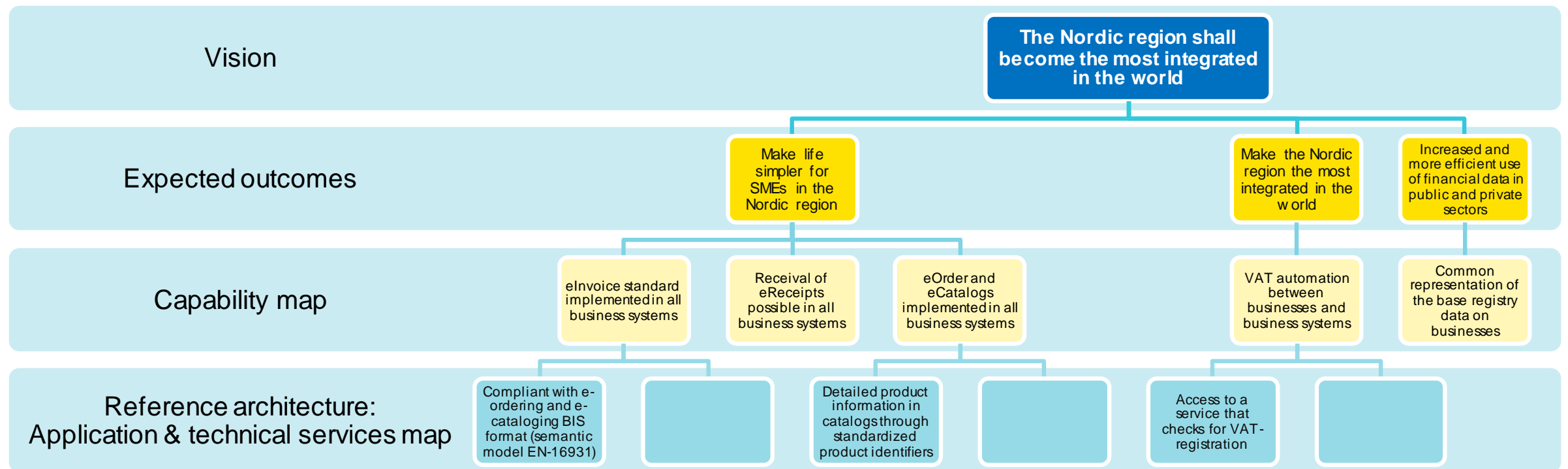
Nordic Smart Goverment is the Nordic Information and communication network of Government agencies.

Nordic Smart Government

Hierarchical capabilities and services (partial example)

Illustrative example of architectural building block fulfilling the capabilities and expected outcomes of the NSG

Vision

> **The Nordic region shall become the most integrated in the world**

Expected outcomes

> Make life simpler for SMEs in the Nordic region
>
> Make the Nordic region the most integrated in the world
>
> Increased and more efficient use of financial data in public and private sectors

Capability map

> eInvoice standard implemented in all business systems
>
> Receival of eReceipts possible in all business systems
>
> eOrder and eCatalogs implemented in all business systems
>
> VAT automation between businesses and business systems
>
> Common representation of the base registry data on businesses

Reference architecture: Application & technical services map

> Compliant with e-ordering and e-cataloging BIS format (semantic model EN-16931)
>
> Detailed product information in catalogs through standardized product identifiers
>
> Access to a service that checks for VAT-registration

Architectural principles in a nutshell

These principles are meant to guide the effort of selecting and implementing the different technical mechanisms that will form the NSG solution.

They may be used as guidelines before selection and/or implementation, or as a checklist after a choice has been made.

- Principle 1: Build on open existing standards
- Principle 2: Use clearly defined, global semantics
- Principle 3: Protect user data
- Principle 4: Built to evolve
- Principle 5: Use secure building blocks
- Principle 6: Enforce data portability

User Principles

The following user principles guide the architectural designing work:

1. I never manually enter information that is already maintained digitally by someone else, like the producers, vendors or the government

2. When I buy and sell goods and services I don't need to make any special arrangements when my trade-partners are in another Nordic country

3. I rarely perform manual steps related to inventory, book-keeping, bank-transactions, VAT- or other government reporting, unless I choose to verify or alter the proposals from my systems

4. If someone offers me a better deal or improved service, migrating to new service providers for services like bookkeeping, inventory, reporting etc is just as easy as changing operator for my cell phone

5. I get feedback during processes, and there is someone who can assure me -- as well as my existing and potential trade-partners -- that everything is OK with regards to my duties towards the Government, so I can sleep well at night and go for a holiday without worrying

6. I am in control of all the transaction and financial data of my business, and empowered to re-use and share the data when I have the need, and I know who is accessing what information, on what legal basis (my consent or government legislation), when and for what purpose

7. I can pick and choose among the best of breed, and use as many business systems by different providers simultaneously as I like, without having to pay for customized integrations

8. When I pay for upgrades of my business systems, I expect improved functionality, not just a set of mandatory updates to stay compliant with new and complex requirements from the Government

9. At any time I have an updated view of the financial situation of the company, including reliable forecasts for the coming weeks, so that I know whether I will be able to pay the salaries or the VAT next week

Bundled actions

The following diagram taken from the NSG Roadmap shows how actions are bundled into three different phases: short term 2020-2023, mid term 2024-2025 and long term 2026-2027. Short and mid term actions illustrated below:
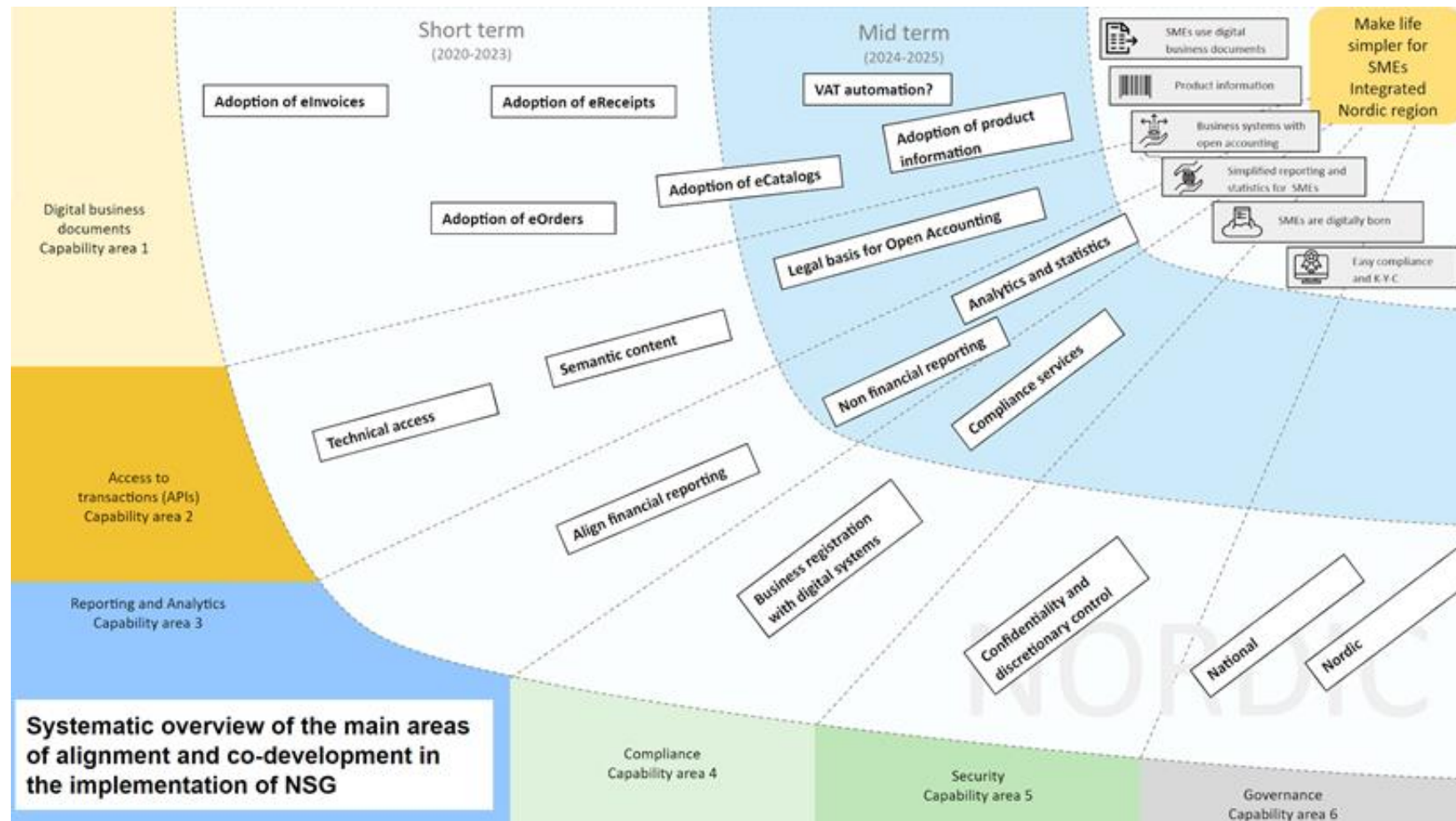
Actors and infrastructure

Summary of the actors and the infrastructure

In this document we propose architectures for the different areas that represent a possible way of realising the necessary functionality. In most cases there are several ways of achieving the same functionality. The detailed architecture decisions must be taken as part of a future process where the relevant stakeholders are involved in the co-creation-process.

- The following slides illustrate the logical application services and standards for the actors and infrastructure within the NSG ecosystem.

- These illustrations are not meant to be comprehensive blueprints for implementations and there can be other possible solutions for the same needs. The proposed architectures might also co-exist with other architectures within the same domain, for instance Peppol and other implementations of EDI. See also slide Peppol and EDI

- All the proposed architectures relies on well-known technologies (APIs, message exchange, addressing). This means that the NSG-vision can be implemented using these existing, well-known technologies. This does not, however, exclude that the future implementation-phase can take advantage of other technologies, for instance Distributed Ledger Technology (DLT).

- The application services will be realised by concrete physical services. These may be provided by private operators, government agencies and/or be mapped to existing solutions.

- Actors and infrastructures have goals and steps that correspond to the actions numbered in the headline. These numbered actions may be found in the Capabilities and business processes of the NSG ecosystem document.

- The terms may vary depending on the concept so treat 'operator', 'data provider', 'access point' and 'vendor' as synonyms as they share similar functionalities

- Readiness for adoption indicated on a scale of low-medium-high:

    High means that standards and technology exist today, but that implementation is not yet completed
    Medium means at least one necessary component is missing, but there is a path to implementation
    Low means that the prerequisites to implementation are ill-defined or difficult to meet

Readiness of eInvoices

Goal

Actions are needed for all business systems to comply with the standards.
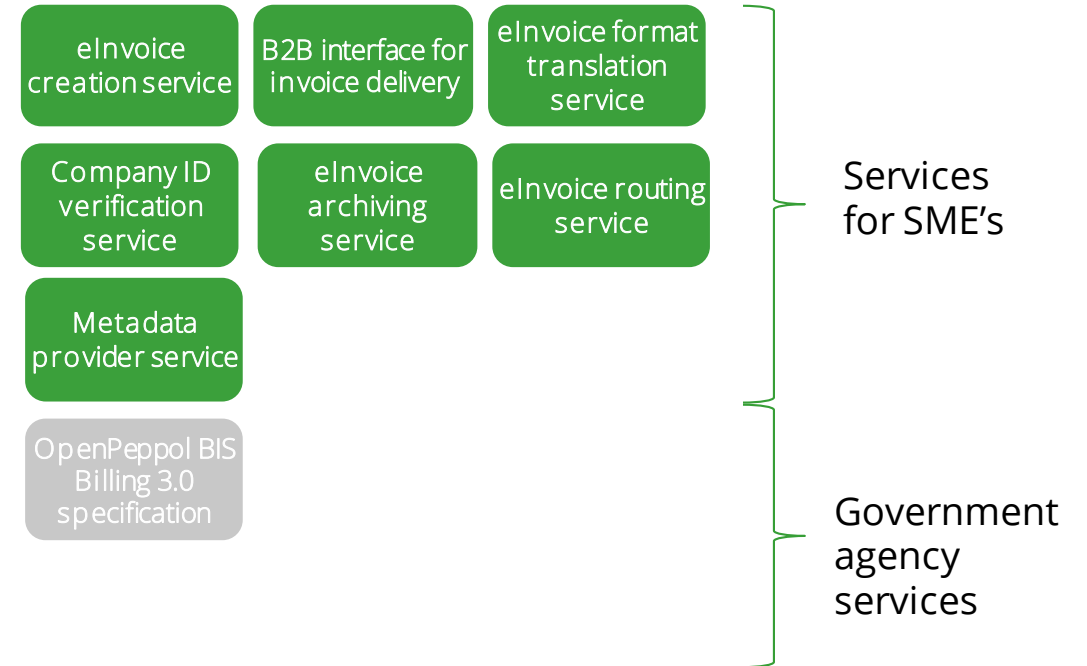Suggested specification is Peppol BIS Billing 3.0.

Steps

- Compliance with eInvoice BIS format

- Complete the implementation of the OpenPeppol BIS standard

- Market the eInvoice feature to their business system clients

- Promote and communicate the benefits to SME's

- Extend the regulation from public procurement to demand sending of invoices from public sector

- Create incentives in public procurement

- Require that when the customer supports eInvoices, suppliers must sent invoices in that format

- Enhance the OpenPeppol BIS Billing-specification to improve support of cross-border VAT

Readiness for adoption: High

- Existing technical services for einvoicing in general are widely spread

- Common standard EN 16931-1 already decided by EU

Possible Applications or technical services required

| eInvoice creation service | B2B interface for invoice delivery | eInvoice format translation service |
| Company ID verification service | eInvoice archiving service | eInvoice routing service |

Metadata provider service

OpenPeppol BIS Billing 3.0 specification

Services for SME's

Government agency services

■ Existing fit or partial fit solutions

■ Further development needed

Readiness of eInvoices (continued): Fully developed eInvoice infrastructure – actions 1.1.1 – 1.1.3 ,1.1.9
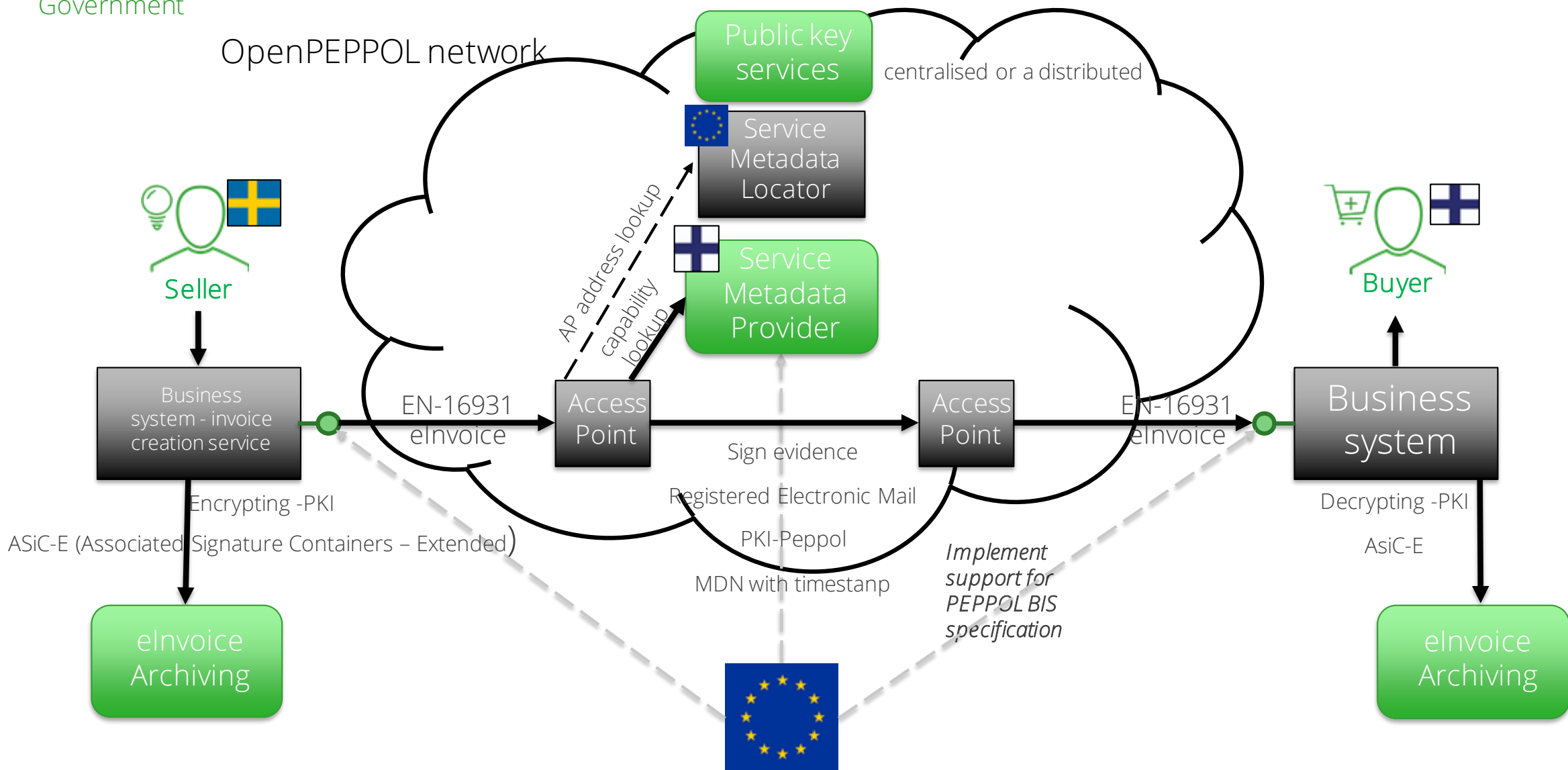
Readiness of eReceipt

Goal

A standardized, cross-border network for sending and receiving eReceipts for bookkeeping and auditing purposes.
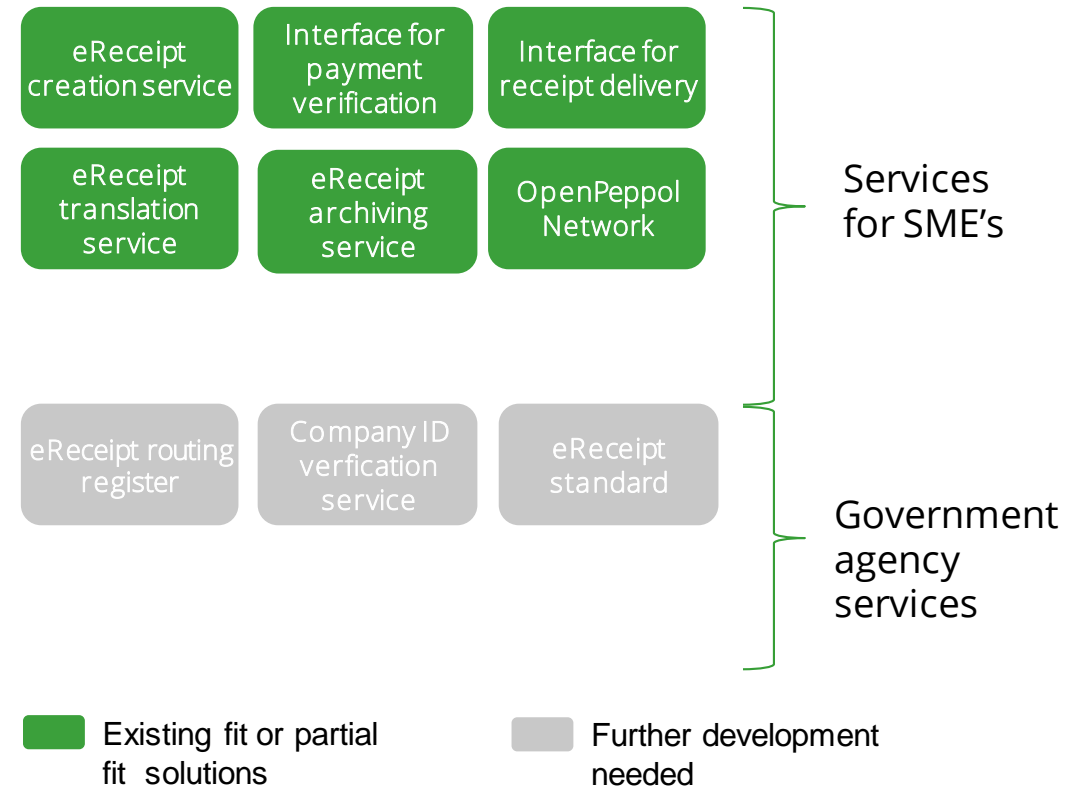
Steps

- Standardize the content of eReceipt
- Implement eReceipt in OpenPeppol network, connecting to the PoS
- Implement eReceipts in Business systems
- Implement mapping and routing from national eReceipts systems to the OpenPeppol network
- Mobile payment services send eReceipts

Readiness for adoption: Medium

- Several networks exist but interoperability and portability needs to be improved (4-corner model)
- eReceipt standardization is ongoing

Possible Application or technical services required

eReceipt creation service	Interface for payment verification	Interface for receipt delivery
eReceipt translation service	eReceipt archiving service	OpenPeppol Network

Services for SME's

eReceipt routing register	Company ID verfication service	eReceipt standard

Government agency services

🟩 Existing fit or partial fit solutions   ⬜ Further development needed
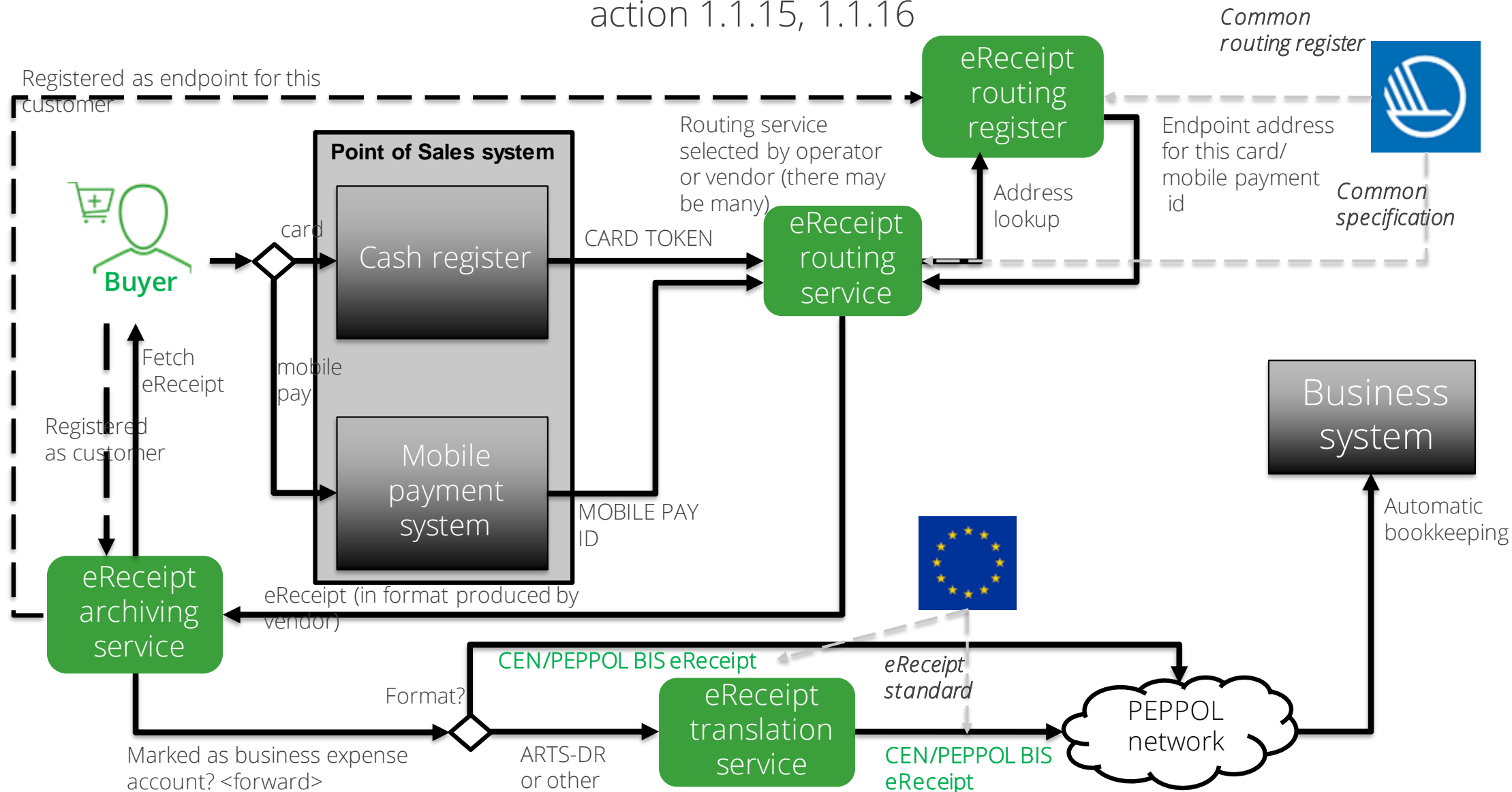
Readiness of Digital Product Information

Goal

- Enable detailed, structured, digital product information available to buyers, through support of identifiers as references in the digital business documents, and ways of accessing the detailed information

- Examples of detailed product information are information about carbon footprint, material composition for circular economy or certification of organic production methods

- There are various identifiers that can be used, e.g. EAN code, EU Harmonized System codes, or other standard product and service category codes (UNSPC for example)

Steps

- Include and process product identfiers, as part of the business documents

- Discover digital product information and access services providing additional information about the product.

- Ordering systems must provide product identifiers

- Enforce the use of product identifiers in the supply chain

- Enforce a best practice for use of product identifiers in eInvoicing

Readiness for adoption: Low

- There is a plethora of product identifier standards and registries, with different uses and scope

- Harmonization requires a lot of work

Possible Application or technical services required

eInvoice creation service	Interface for payment verification	GS1 product registry
eReceipt creation service		

Services for SME's

Product registry lookup	Customs product code registry	Statistic categories registry
Stadardized API product access		

Government agency services

■ Existing fit or partial fit solutions   ■ Further development needed
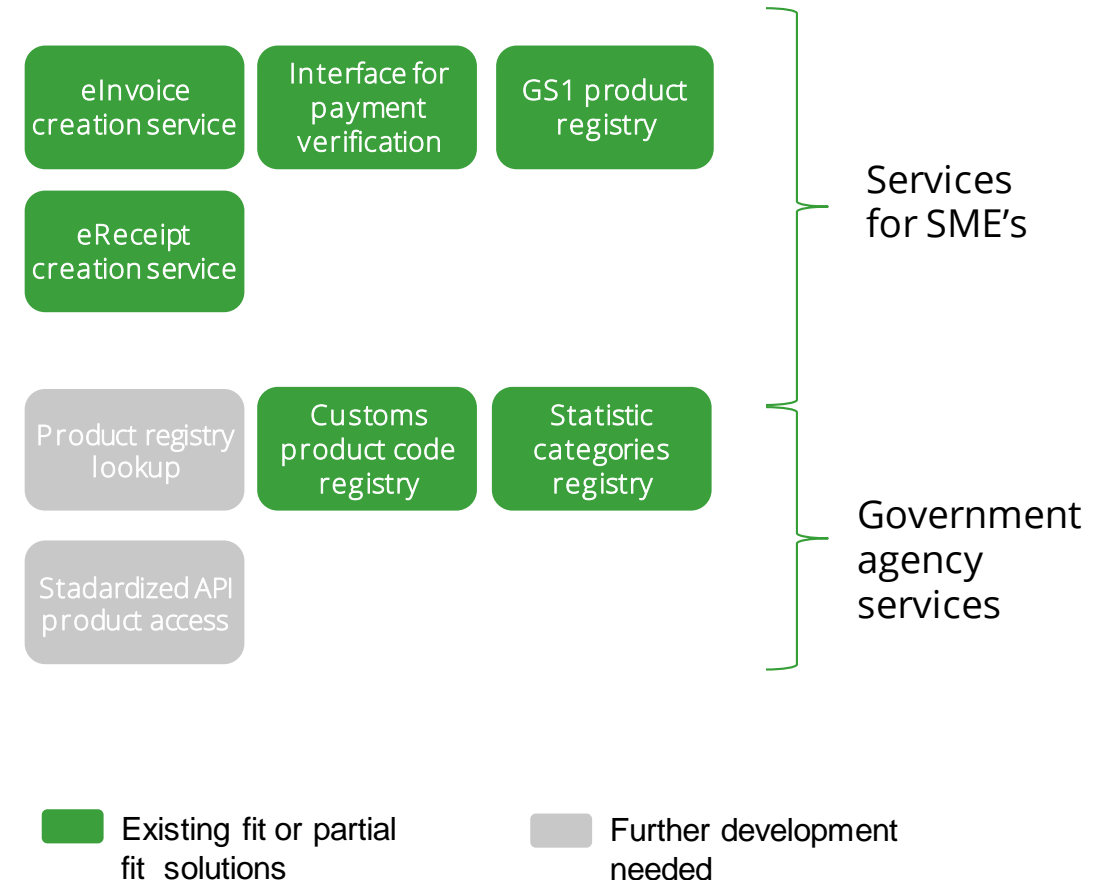
Readiness of Digital Product Information (continued): Product information lookup – action 1.2.5

Seller

Buyer

Specific product data needed, eg. fire safety classification.

Business system

eInvoice:
- product ID
- product registry ID

PEPPOL network

Business system

Common lookup register

Product registry lookup

1. Find endpoint of registry from central lookup

Common API specification

Product information registry, id GS1

Product information registry, id CAS

Product information registry, id XYZ

2. Get data using standardized API

2020-02-09

Readiness of Business Document immutability

Goal

- Ensure integrity for business documents and prevent tampering

- Prevent illicit double use of business documents

Steps

- Provide access to digital business documents validation services that check that necessary contents are present and used codes etc. are correct

- Provide services that register usage of business documents (eg. eReceipts) in order to make sure that a document is only used once. This enables automated checks (based on hash calculations)

Ready for adoption: medium

- Existing solution for signing and validation exist and emerging technologies are maturing

- Common services and interoperability is missing

Possible Application or technical services required

Product code validation service	Hash verfication service	Automated document check engine
Business document validation service	**Document signing service**	**Peppol document validation service**

Services for SME's

Hash Database	Hash-calculation service

Government agency services
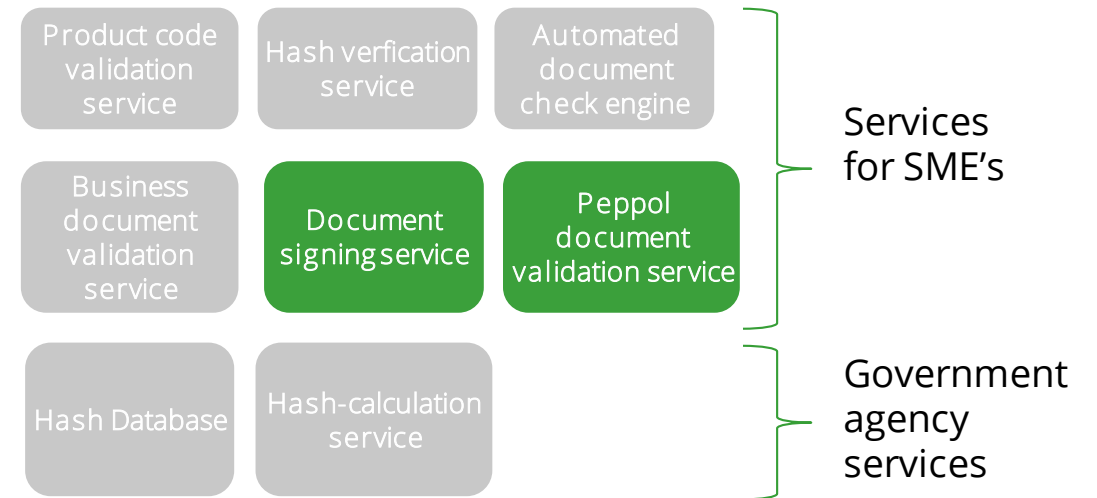
🟩 Existing fit or partial fit solutions   ⬜ Further development needed

Readiness of Business Document immutability (continued): Business document immutability – action 1.3.2

Seller

Buyer

(Alternative transport methods)

Business system

eInvoice

PEPPOL network

eInvoice

Business system

eInvoice hash

eInvoice hash

Auditor

Is this eInvoice unchanged?

Business document immutability service

Has this eInvoice been claimed as expense more than once?

Tax agency

Common API specification

Hash database
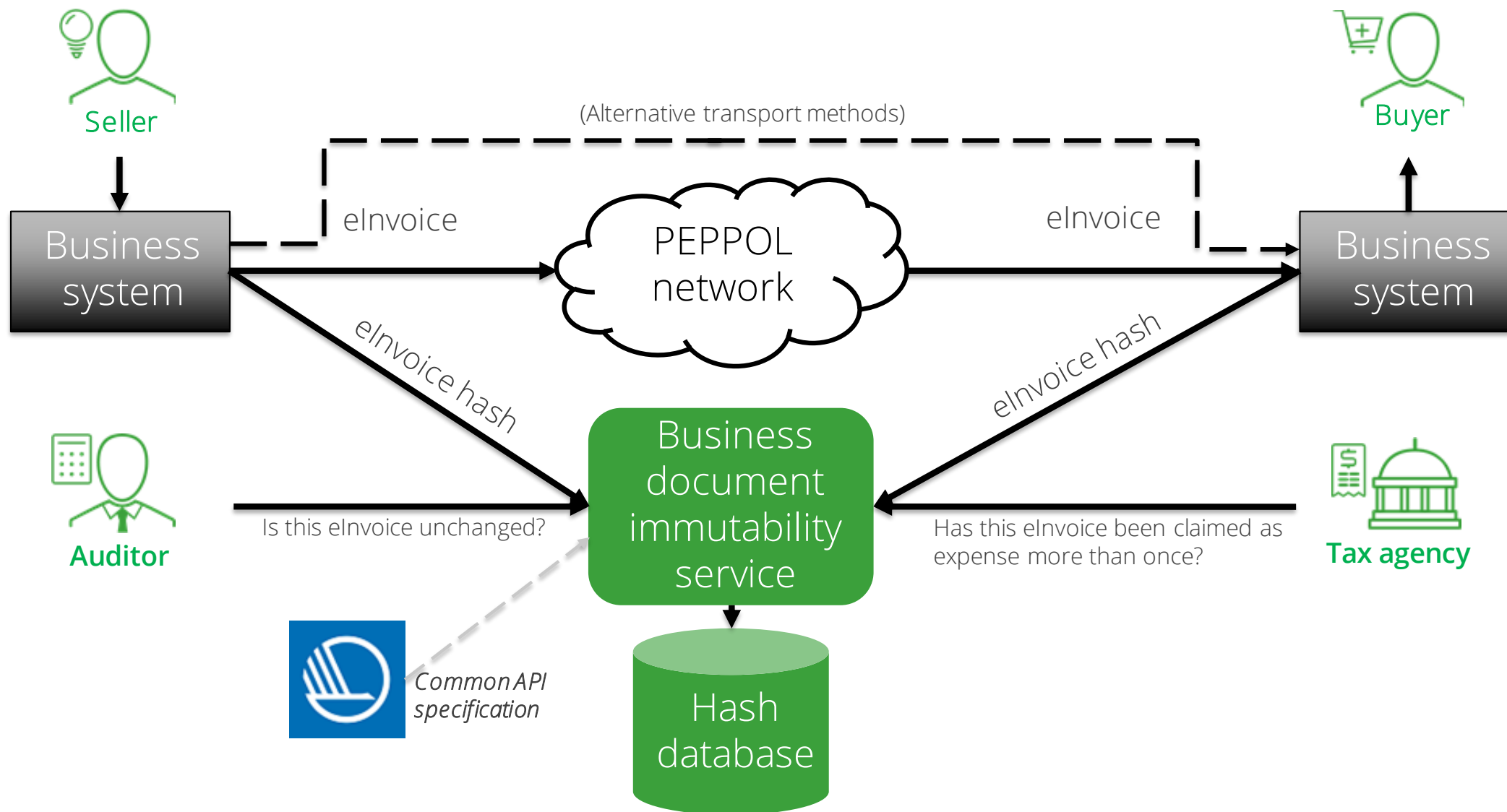
Readiness of Store references to documents

Goal

- Using digital proofs of transaction instead of current process of storing paper vouchers for a number of years as a copy for both parties of the business transaction

Steps

- Enforce a system where sales documents are not sent at all, but stored in one place and being referenced. Eliminates the challenges of having different copies at each end

- Legal changes to remove the need to store and archive copies of business documents

Ready for adoption: low

- The Nordic countries have different legal requirements in this area and some allow changing of documents after transmission

- There are technical solutions for secure off-site storage, eg. in distributed networks, but standards are lacking

Possible Application or technical services required

Document storage	Digital transaction validation	Document store API

⎤ Services for SME's

Document standard	Common API specification

⎤ Government agency services
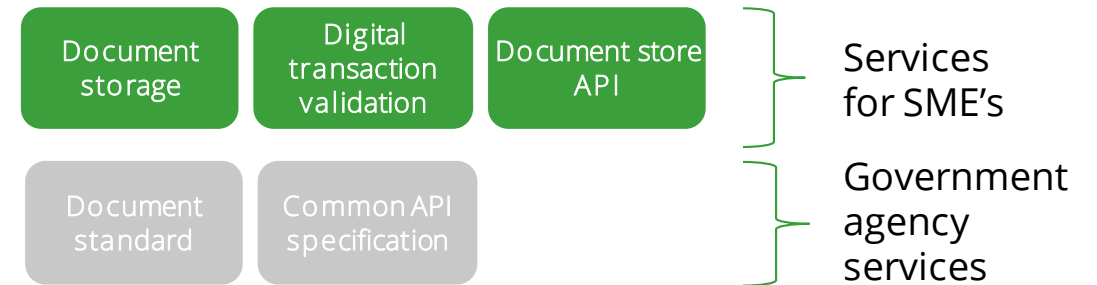
🟩 Existing fit or partial fit solutions   ⬜ Further development needed

Readiness of Store references to documents (continued): action 1.3.3

Seller

Buyer

(Alternative transport method)

Invoice reference + address

Business system

eInvoice

PEPPOL network

Business system

Store with third party

Retrieve

Common API specification

Document archiving service

Retrieve for audit

Auditor

Invoice

2020-02-09
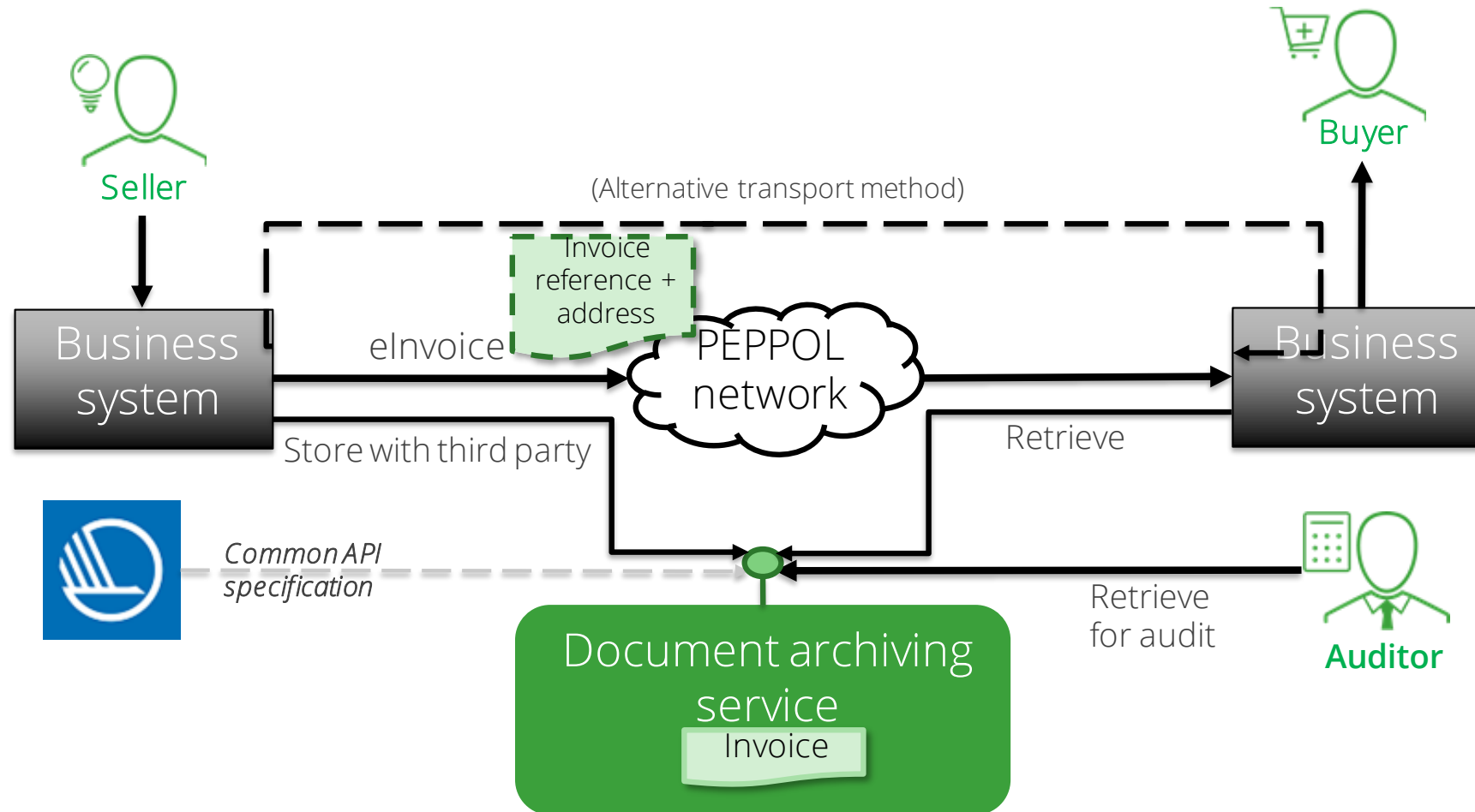
Trusted government services for secure business

Goal

- Doing business cross-border increases the need for services that enable the necessary trust between trade-partners. Nordic Governments are key actors in establishing the necessary level of trust, through authoritative information about businesses.

- The Nordic Governments need to make the relevant information easy accessible in a standardised way across the Nordic countries

- Examples of relevant information include confirmation that the trading partner exists, is registered for VAT and has paid taxes, as well as ownership ("beneficial owners")

Steps

- Access to a service that checks the validity of a bank account number against the company number

- Access to a service that checks for VAT-registration

- Access to a service that checks the "seriousness" and compliance of a company (taxes paid, VAT paid, annual accounts delivered)

- Access to a service that checks that trading partners really exist before sending documents (is registered in business registries)

- Implement warning services for factual events about a company (gov. data: forced proceedings, persons not allowed to do business)

Ready for adoption: high

- Common Nordic business registry lookups and API's are missing which are technically quick to implement

- The Single Digital Gateway Regulation (SDGR) and accompanying Once Only Principle-Architecture has relevant requirements, services and standards

- Connecting the data points with validation and lookup services can be used to provide legitimacy checks

Possible Application or technical services required

Business registry API	VAT-registration confirmation	Compliance Services
Bank account validation service	Company rating service	
Government API lookup service	Common Business registry lookup	

Services for SME's

Government agency services
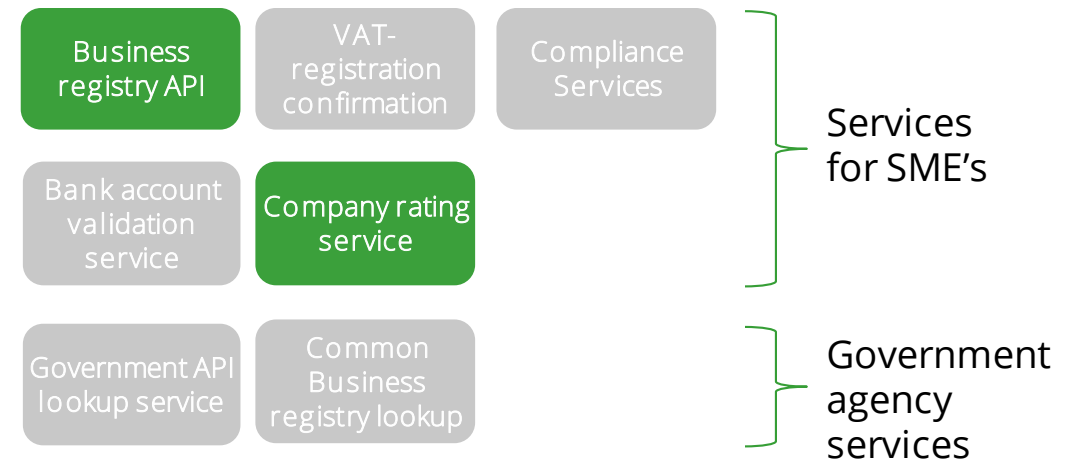
■ Existing fit or partial fit solutions   ■ Further development needed
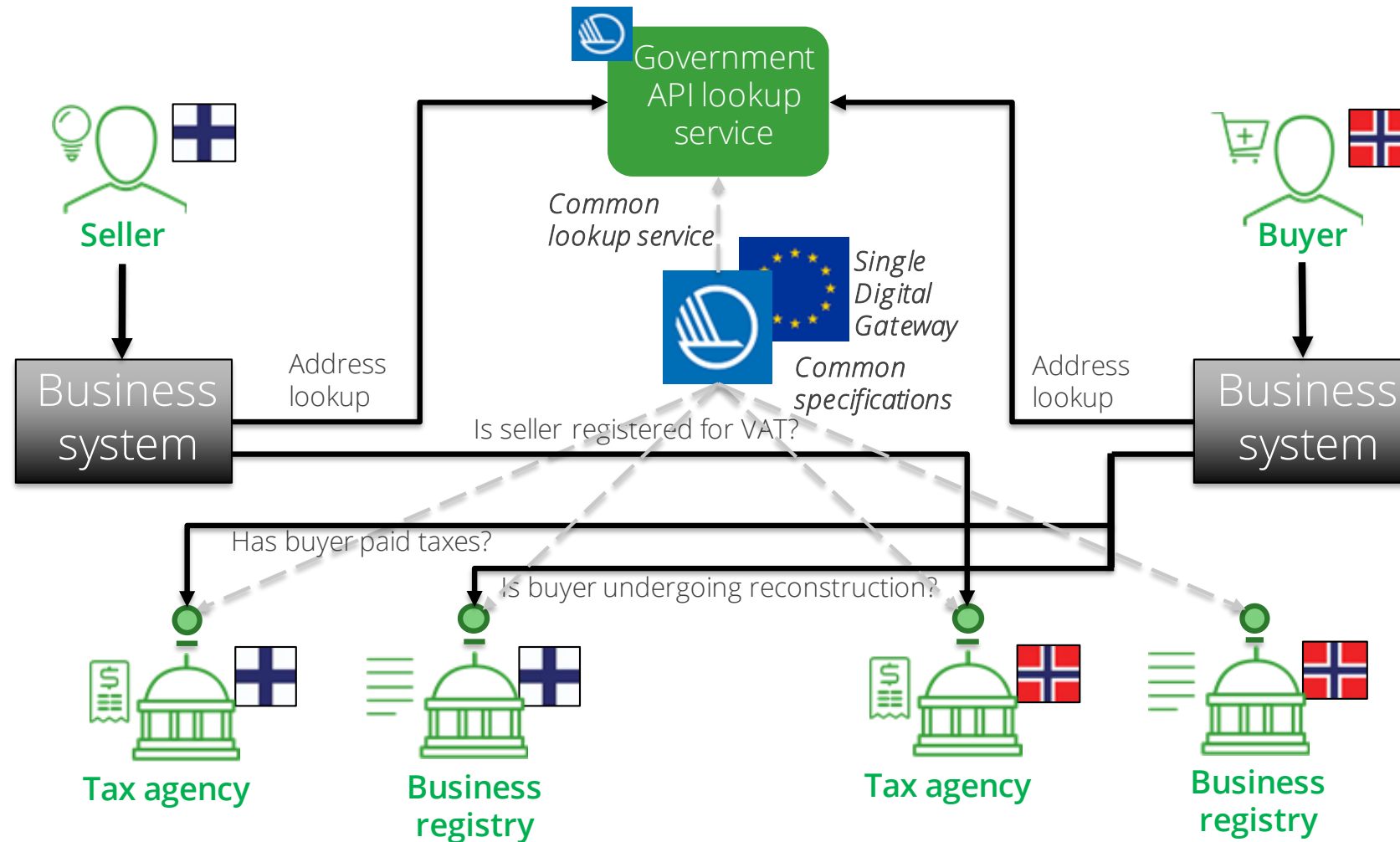
Readiness for Business system API and eAddressing

Goal

Enable standardized ways for integration while supporting portability of business data without customization

Steps

- a standardized service, API, for accessing transactional data from a business

- a (standardized) role based authorization service for the businesses to grant access to different parties to read/write data

- implement a standardized format for transferring detailed bookkeeping data between systems (portability)

Ready for adoption: low

- Bookkeeping standards are implemented by the business systems, but implementation is nation-specific and not Nordic.

- Lack of a common chart of accounts hampers portability

- Common business services are not fully interoperable and need further development in services supporting portability

Possible Application or technical services required
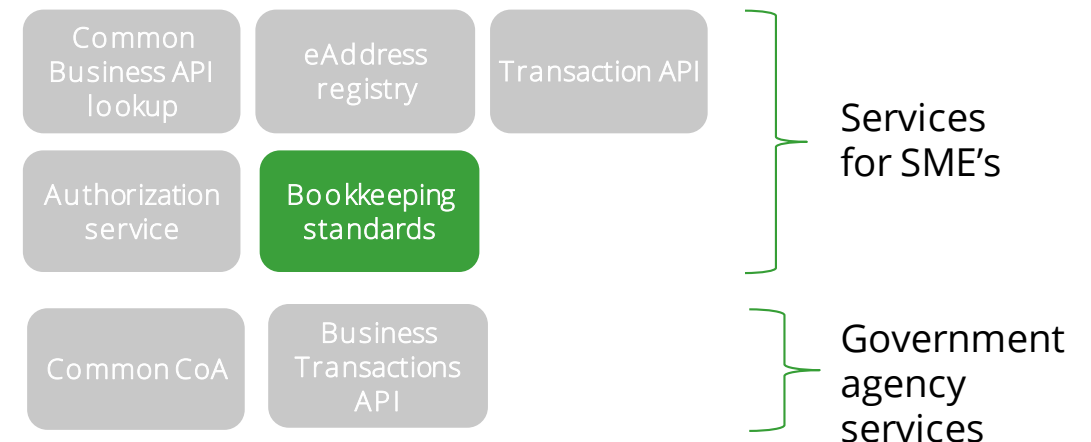
Common Business API lookup	eAddress registry	Transaction API
Authorization service	Bookkeeping standards	
Common CoA	Business Transactions API	

Services for SME's

Government agency services

🟩 Existing fit or partial fit solutions   ⬜ Further development needed

Nordic Smart Government

Business system API and eAddressing (continued) – action 2.1.1, 2.2.2

Common lookup service

Business system API lookup service

Business API address lookup

Common specification

Business

Business system

Get aggregate information for due diligence purposes

Get transactions for audit

Bank

Tax agency

Access granted by business owner
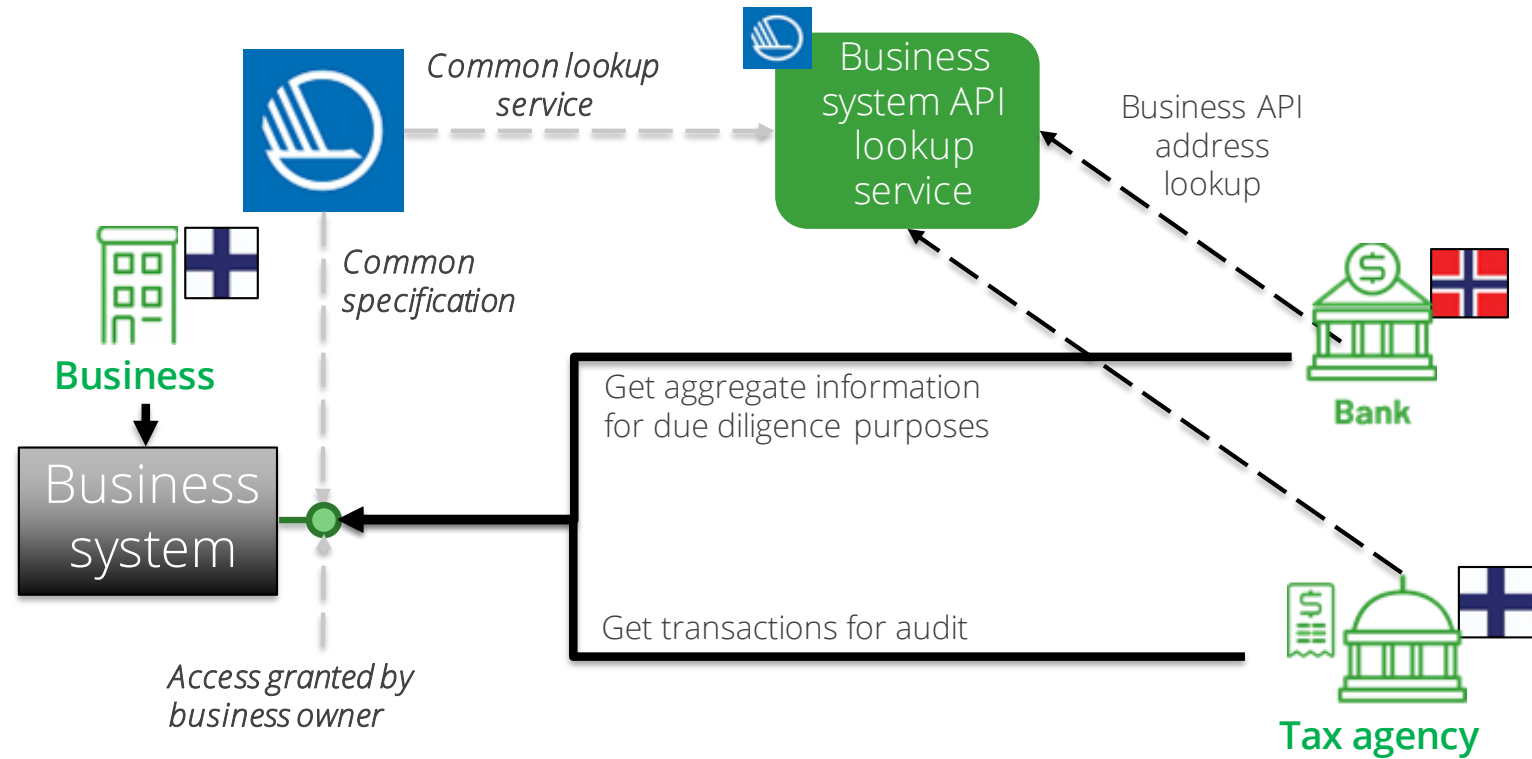
Powers and mandates

Goal

Authentication of an information consumer in a business system is necessary to make sure that only an intended consumer gets access to the system and information within

Steps

- Provide authorization by power of mandates

- Provide authorization through user's consent in B2B

- Provide authentication of a company (eID for businesses)

Ready for adoption: medium

- Multiple different national registries exist but they are not consolidated on a Nordic level

- Further development of common services is needed for seamless verification of powers and mandates in the Nordics - lookup and verification services

Possible Application or technical services required

| User consent service | P&M registry lookup | Role & rights mgmt service | Services for SME's |

| Mandate verification API | P&M registry | eID registry | Government agency services |
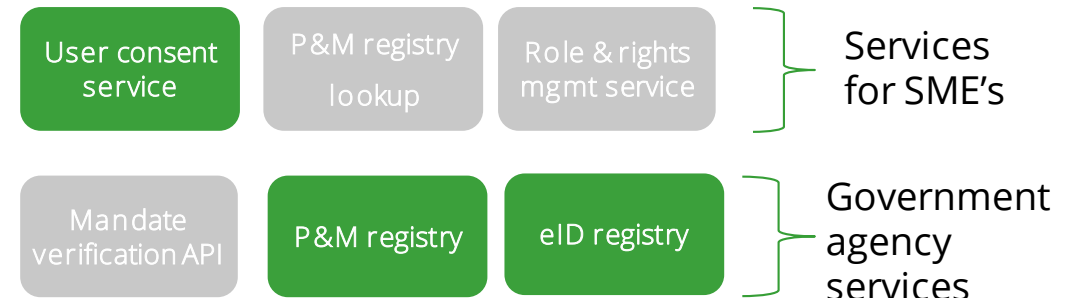
🟩 Existing fit or partial fit solutions

⬜ Further development needed

Powers and mandates – action 2.1.2

Nordic Smart Government

Common specification and infrastructure

eIDAS Infrastructure

Identified by

Identified by

Powers and Mandates registry

Powers and mandates registry lookup service

Bank officer

Entrepreneur

1. Give mandate to bank

5. Confirm mandate to release information

3. Get mandate

2. Get address to P&M registry

Business system

4. Request information

Bank

Business

Common specification

Common lookup service

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Operator (service provider) mapping to assesments

Nordic Smart Government

Standardized eReceipts
- StoreBox
- ReceiptHero
- Kuittilompakko
- eTasku
- Findity
- Kwick

Sharing detailed Business transaction data
- SAF-T (audit)
- XBRL-GL
- XBRL
- SIE 1 to 5
- BAS (CoA)
- UNCEFACT (data model)
- ISO21378 Audit Data Collection

Identification & Authorization
- BankID
- Commfides
- Buypass
- MinID
- ID-porten
- Altinn Auth.
- Suomi.fi (eIDas)
- Incomes Register's certificate service
- SisuID
- Freja ID
- BankID
- DIGG (eIDAS)
- NemID
- MitID
- IceKey (Íslykill)
- Auðkenni

Common set of Nordic goverment open and free API's
- Felles datakatalog
- data.brreg.no
- liityntäkatalogi
- Suomi.fi (X-Road)
- Vero-API
- Avoindata.prh.fi
- Dataportal.se (DIGG)
- Productpaket (Bolagsverket)
- datahub.virk.dk
- CVR at Virk (business reg.)
- CVR at Virk (annual account)
- Basic Data register
- eSKAT (income & annual tax)

Powers & Mandates
- Register of legal entities
- Altinn Auth.
- Maskinporten
- Suomi.fi (eAuthorizations)
- Suomi.fi (eIdentification)
- SisuID
- Findy
- Nationell behörighetslösning
- NemLogin
- MitID

eInvoice
- OpenPeppol BIS Billing 3.0
- Finvoice
- Teapps
- Nemhandel (UBL)
- CENBII

Mechanisms for enforcing user consent before delivery of protected data
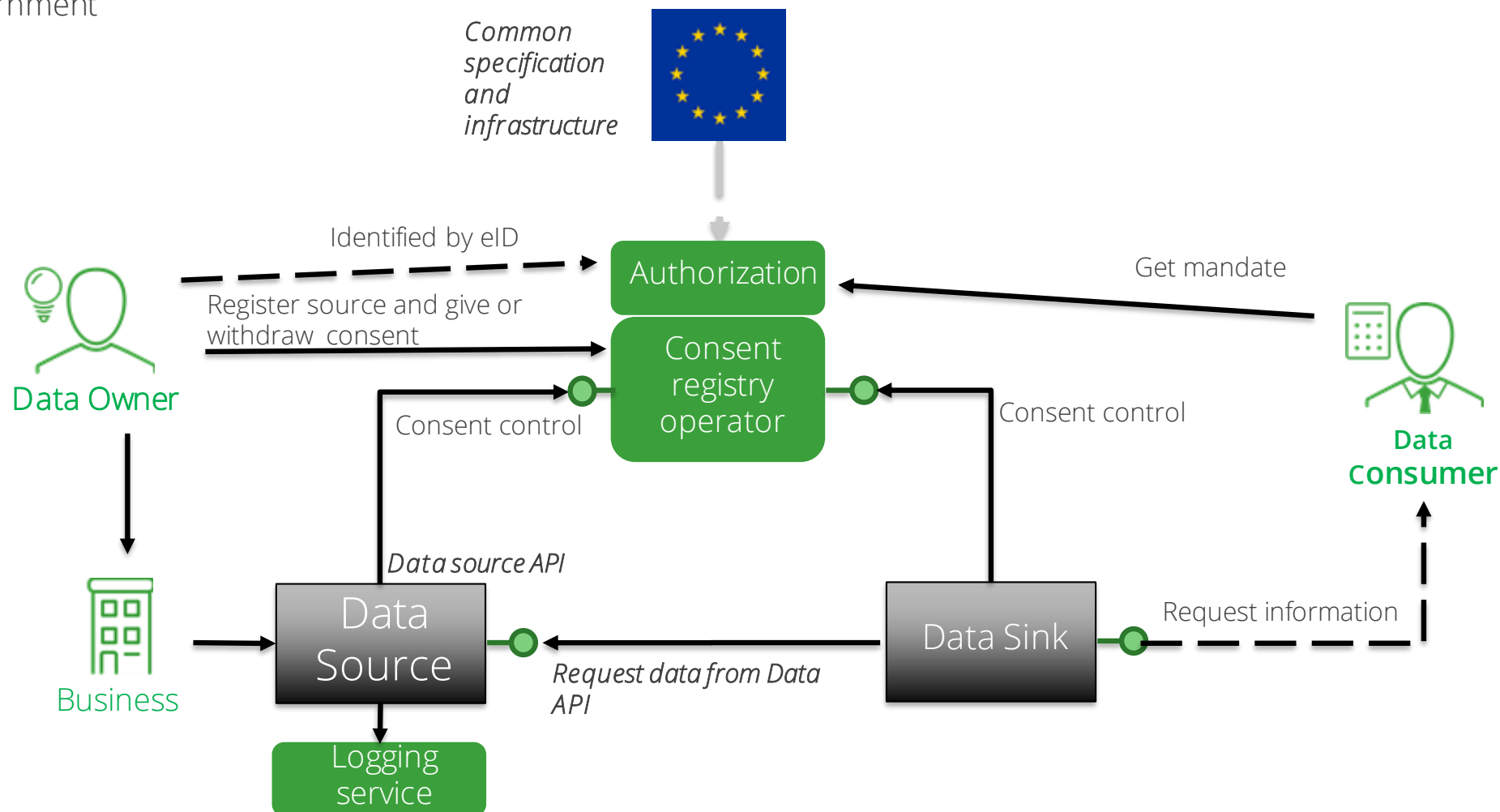- Altinn Consent
- MyData
- Suomi.fi (eIDas)

Legends
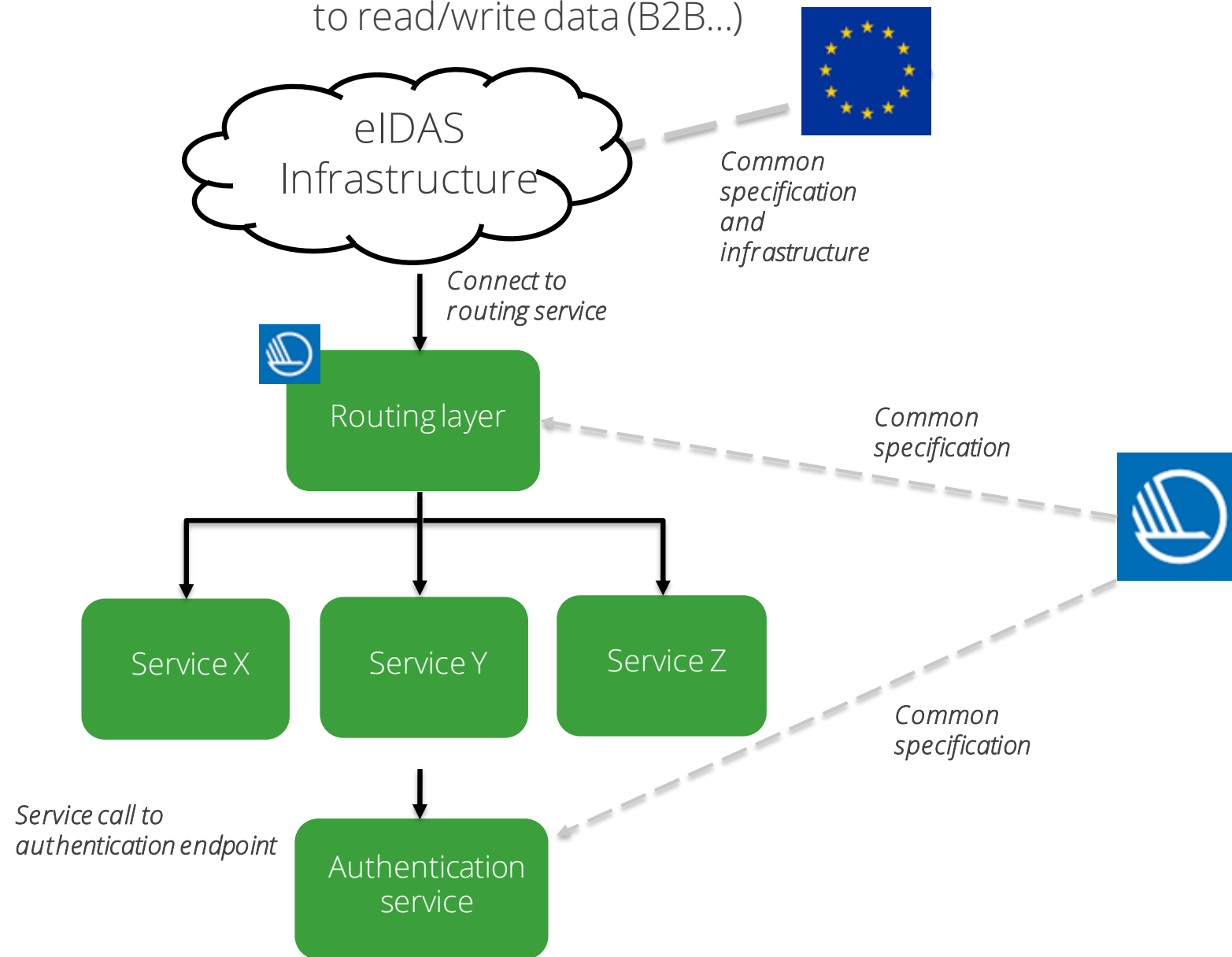- Nordic or Global
- Govermental/Public
- Commercial

*These are the so far identified service providers

Nordic Smart Government

Mechanisms for enforcing user consent before delivery of protected data: Provide authorization through user's consent in B2B – action 6.1.1

Slide added in the external review version April 2020

Common specification and infrastructure

Identified by eID

Authorization

Get mandate

Register source and give or withdraw consent

Consent registry operator

Consent control

Consent control

Data Owner

Data Consumer

Consent control

Data source API

Business

Data Source

Data Sink

Request information

Request data from Data API

Logging service

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Nordic Smart Government

Identification & Authorization: service for the businesses to grant access to different parties to read/write data (B2B…)

Slide added in the external review version April 2020

eIDAS Infrastructure

Common specification and infrastructure

Connect to routing service

Routing layer

Common specification

Service X

Service Y

Service Z

Common specification

Service call to authentication endpoint

Authentication service

2020-02-09

Example of national readiness heatmap: Finland

Peppol and EDI

- EDI and Peppol are expected to co-exist in the foreseeable future
- Typically Use Cases:
  - EDI: Tight integrations of actors in a value chain, due to rich set of document types and information elements, which enable tailoring to specific industries, and were actors are known in advance. The higher level of integration enables higher levels of automatisation, but requires more resources
  - Peppol: "One-off"-integrations, where actors can exchange single document types (typically invoices) with no prior knowledge of each-other. Document types are fewer and more restricted, reducing functionality relatively to EDI, but adoption requires less resources
- Service Providers can perform transformation between different EDI-networks and Peppol for their customers
- EDI as the specific, Peppol as the default
  - A company that uses EDI with partners in a value chain, will still benefit of Peppol for sales and purchases with actors outside the value chain, for example their phone bill, insurance costs, a one-time consultancy contract or course etc
- Government requires Peppol
  - As a result of EU-regulation, it is mandatory for all Nordic Governments to require Peppol BIS Billing as part of Public Procurement
  - All governmental bodies and all companies selling to public sector are thus likely to have Peppol-support as a requirement for its business systems
  - Experience from Norway where the same requirement has been in force since 2012, shows that such requirement has resulted in nearly 100 % of the business systems supports Peppol BIS Billing (sending and receiving)
- To enable exchange of electronic business transaction documents for SMEs in the Nordic Countries, NSG recommends support for Peppol as a minimum requirement for the parties in the ecosystem