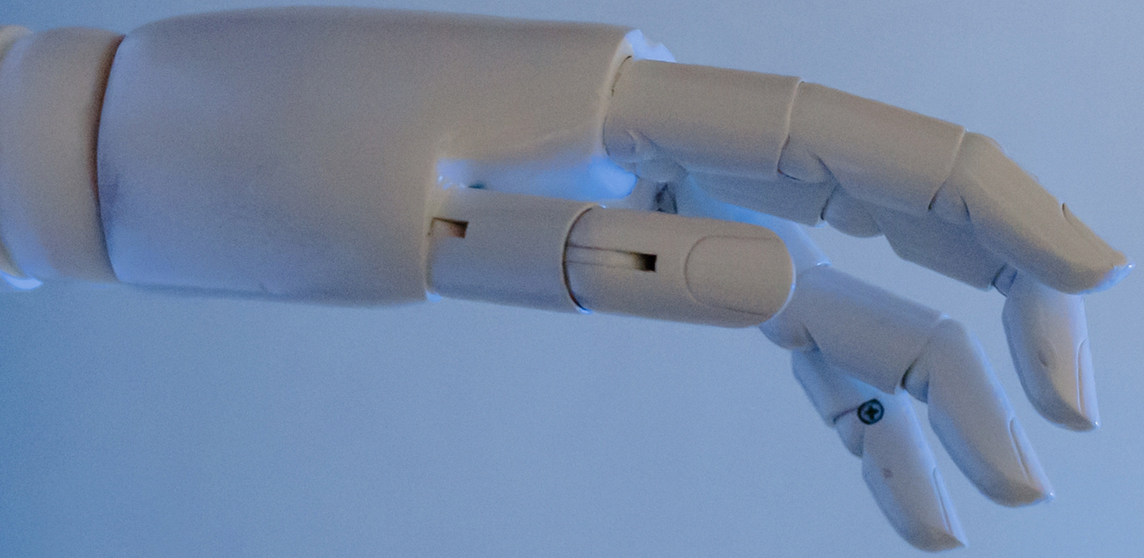
Inclusive and Simplified Interface for E-Health and Basic Services



Chiara Cappellini, Dinar Gareev,
Fang Du, Neda Fallah

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Actors

01

Patients

Patients want the existing and future technologies to fit their expectations for e-healthcare in general, and their own personal needs and capabilities

02

Doctors

Doctors are expected to do their best to adapt their practices to using e-health solutions for maximum benefits while promoting their use to patients

03

Government

Government and its agencies are capable of providing funding and resources for development and usage of tools promoting inclusive use of e-healthcare

04

Technology

Technology should be equally available and accessible with consideration of all possible needs of all actors to support the widest adoption and maximum efficiency

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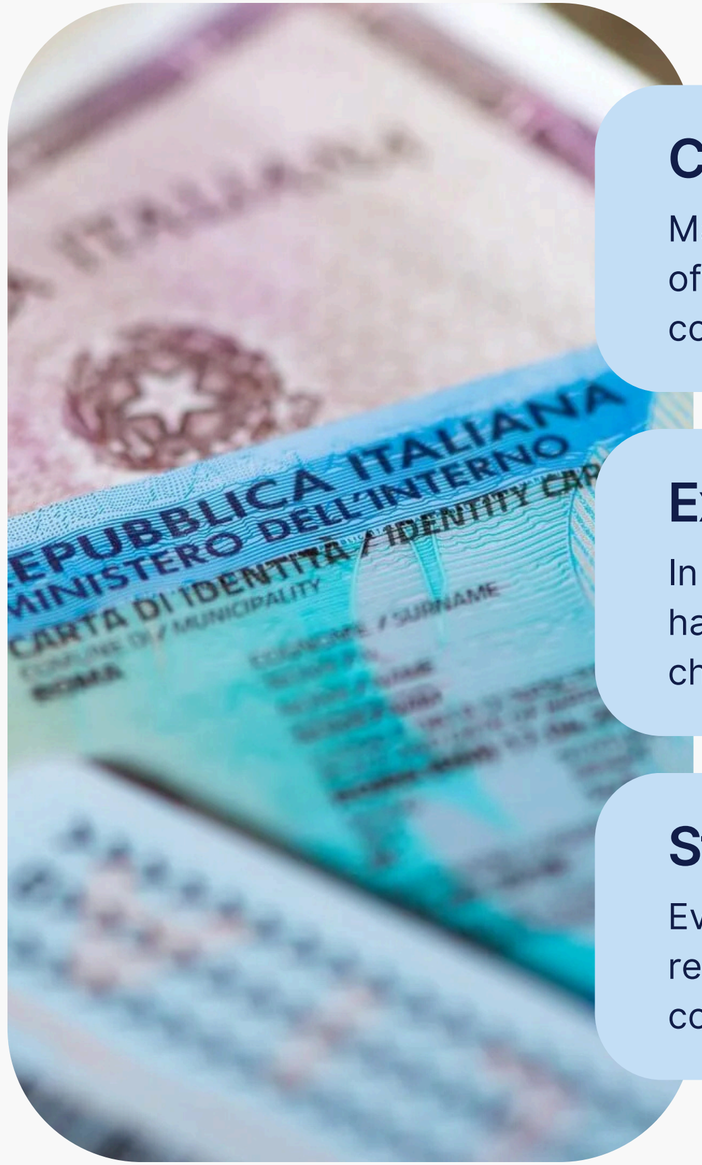
Authorisation Problems



Complicated systems

Main authorisation systems (SPID, CIE) offer multiple redundant options causing confusion

Expiring QR codes

In order to successfully log in, the user has to scan a QR code that rapidly changes which might cause frustration

Strict MFA protocols

Even the basic authorisation systems require strict multi-factor authorization codes

64.9% of respondents require assistance from younger family members, and **26.8%** more rely on friends to access these services. This statistical distribution highlights a structural reliance on external intermediaries simply to initiate authentication.

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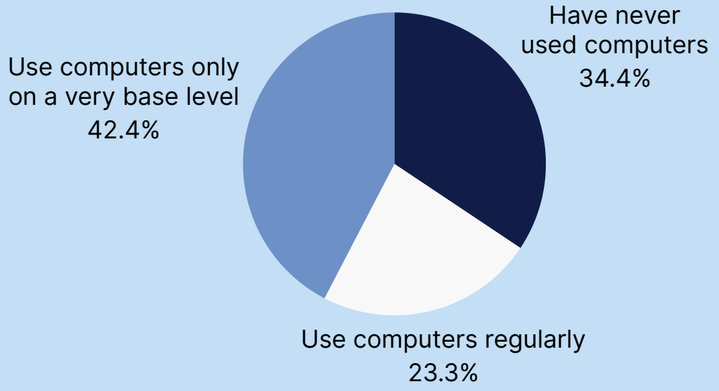
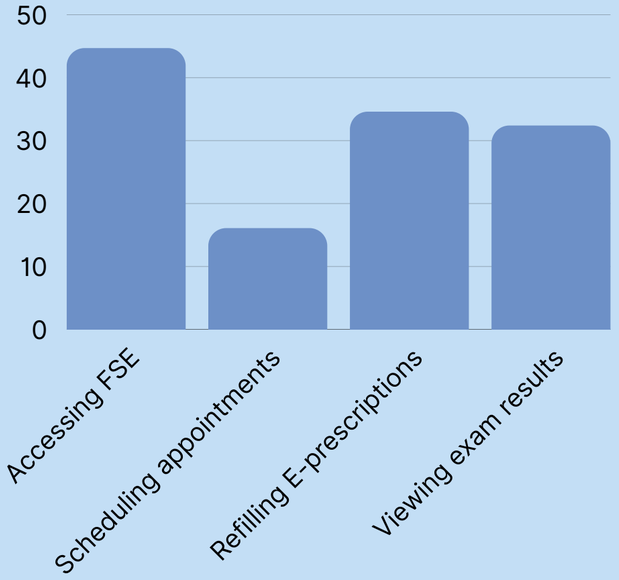
Patient Profile

North-South divide in nationwide e-government services usage

Low rates of general computer proficiency level



Low adoption of main existing e-healthcare services



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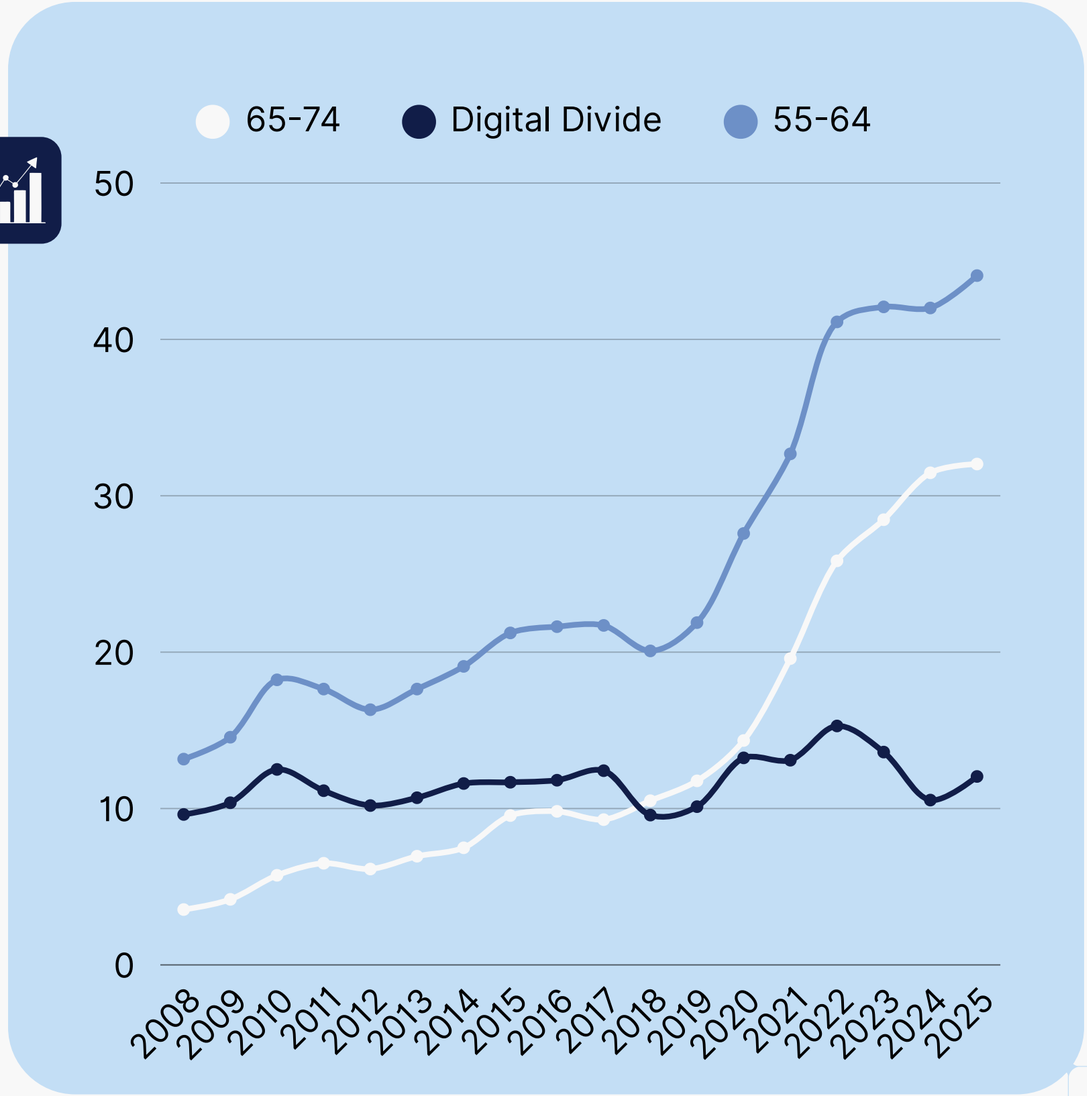
General Picture

- **Low Rates of e-government usage**

  From 2008 to 2025 the rates of the usage of government services via the Internet have remained lower than 50% for both 55-64 and 65-74 year-old cohorts

- **Digital Divide**

  The Digital Divide remaining constant reliably confirms that the technological exclusion generated by digital government interfaces across Italy is not resolving naturally, but rather persists as an ongoing, systemic issue.



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Doctor's Perspective

Prevention of hospitalizations

Proactive tools can help doctors to intervene early and keep patients comfortably at home

Management of chronic diseases

Tools facilitate the continuous monitoring of vital signs, optimizing the day-to-day management of complex conditions

At-home patient safety

E-health systems ensure rapid emergency response times during adverse events, enhancing overall patient safety

57% Medical Records

37% Digital Prescriptions

33% Data Collection

The Policy Gap:

Online Services ≠ Autonomous Access

Policy Context: PNRR

Key investments

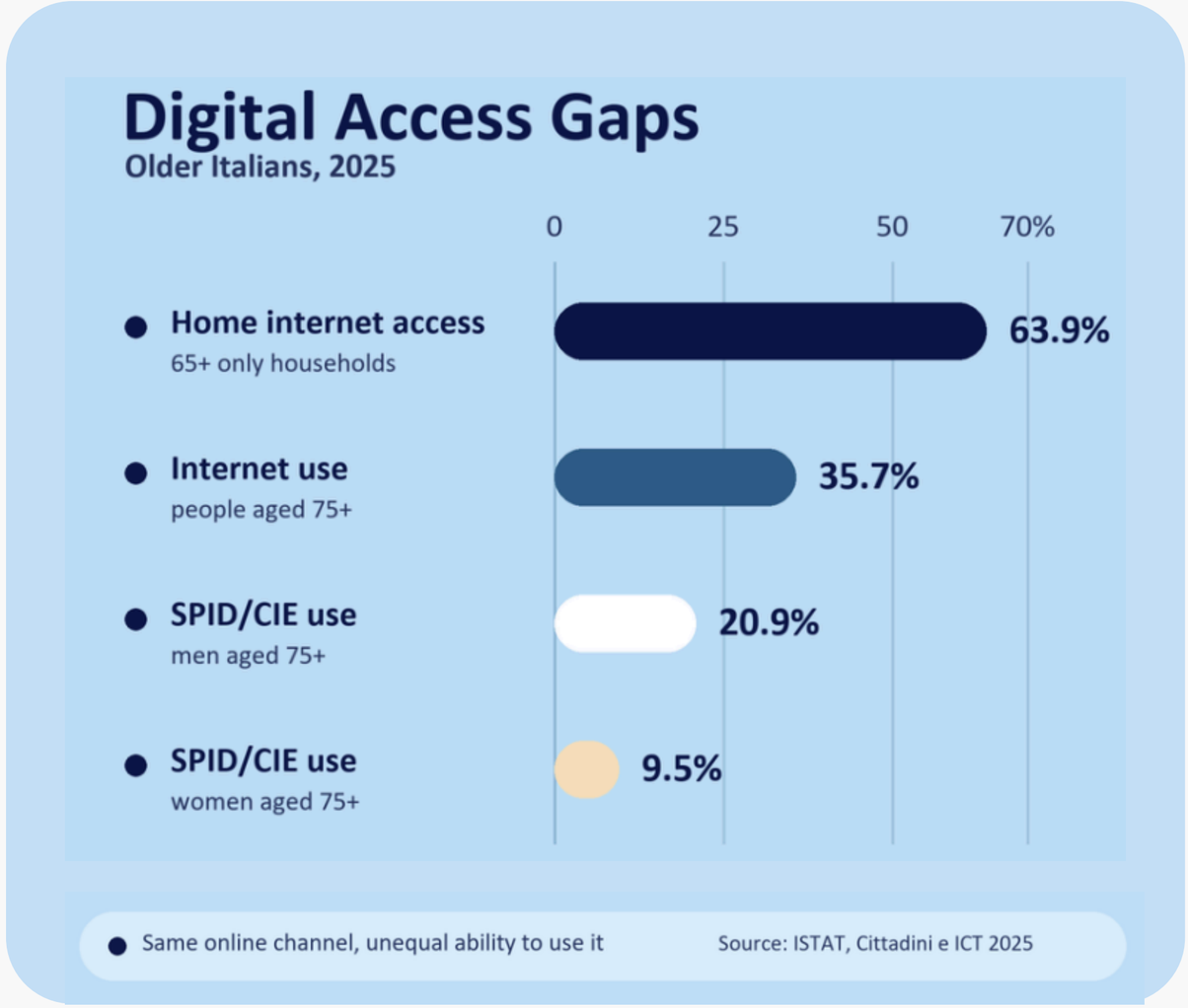
- Digital health infrastructure: EUR 1.6B+
- Telemedicine: EUR 1.5B
- Digital skills support: EUR 195M

What is the problem?

- Investment ≠ inclusion：PNRR strongly funds digital health infrastructure, but infrastructure does not guarantee actual use.
- Equality logic：The same digital channels are offered to everyone: SPID, CIE, FSE.
- Equity gap：Older adults have unequal digital literacy, confidence, mobility, and family support.

Result

Online services exist, but autonomous access remains low.



Servizio Civile Digitale & Punti Digitale Facile

What they are designed to do

- Demand-side interventions under PNRR Mission 1, Investment 1.7
- Target users' digital capability, not only infrastructure
- Goal: provide training or facilitation to 3 million citizens

How they work

- SCD: trained young volunteers provide digital skills coaching
- PDF: fixed/mobile service points offer free assistance in public places
- Support includes SPID activation, FSE access, and online public services

Why this is still not enough

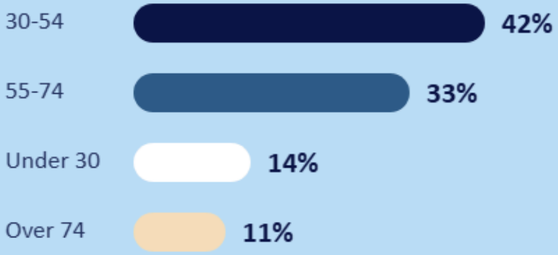
- Skills training assumes users can reach support points
- It also assumes users can remember complex procedures afterwards
- Mobility decline, cognitive load, sensory decline and low self-efficacy remain barriers

Monitoring Signal

Punti Digitale Facile, Nov. 2025

- **Over 2 million** citizens reached

Users by age group



Health-related support

Health services	>25%
FSE access	11%

- High coverage, unequal elderly reach

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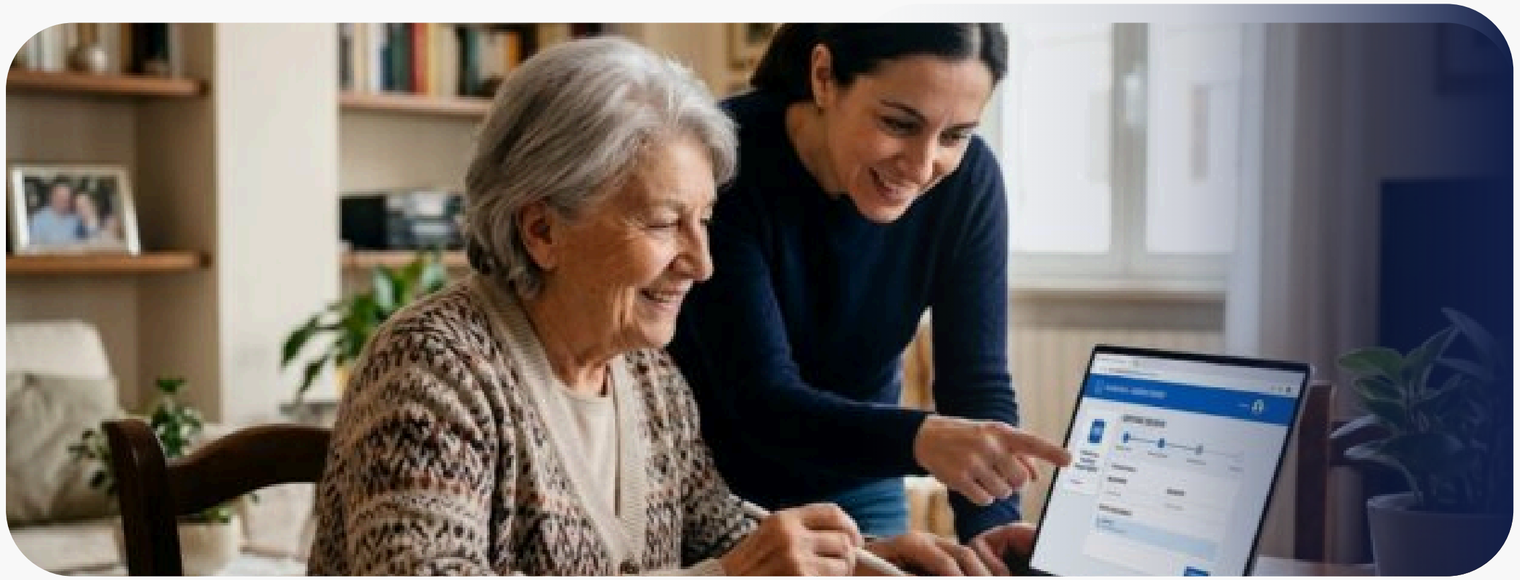
Delega Digitale: Access Through Others



What is it?

A formal delegation mechanism allowing citizens to authorize a trusted person to access digital public services on their behalf.

Fairness concerns

- **Privacy of health data:** Delegates may access FSE records beyond what older adults fully understand or intend to share.
- **Quality of healthcare:** Proxy access may affect patient-clinician communication, especially around sensitive information.
- **Informed consent:** Users must understand delegation types, visible data, protected data and revocation.
- **Coverage gap:** Delegation assumes a trusted and capable proxy; older adults living alone may remain excluded.

What It Solves

Restores access for users who cannot navigate digital health services independently.

What It Risks

Access is gained through another person, so privacy and autonomy may weaken.

From Policy Gaps to Device Adoption

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What policies cannot fully solve

- **Interface complexity**: Training can explain a process, but it does not make SPID, CIE or FSE cognitively simple.
- **Fragile autonomy**: Assistance and delegation restore access, but often keep older adults dependent on others.
- **Repeated-use burden**: E-health access is not a one-time task; users must log in, remember steps, manage updates, and repeat procedures.
- **Hidden exclusion**: Aggregate targets can improve while the oldest, least confident, or least supported users remain outside.

Public Provision

Public procurement, subsidies or free provision through regional health systems.

Goal: device access should not depend on income or family resources.

Referral Mechanism

Family doctors, pharmacies, social workers and Punti Digitale Facile identify high-need users.

Goal: reach those least likely to actively seek technology.

Ongoing Support

Assisted activation, identity connection, troubleshooting and repeated-use help.

Goal: distribution becomes real adoption, not just device delivery.

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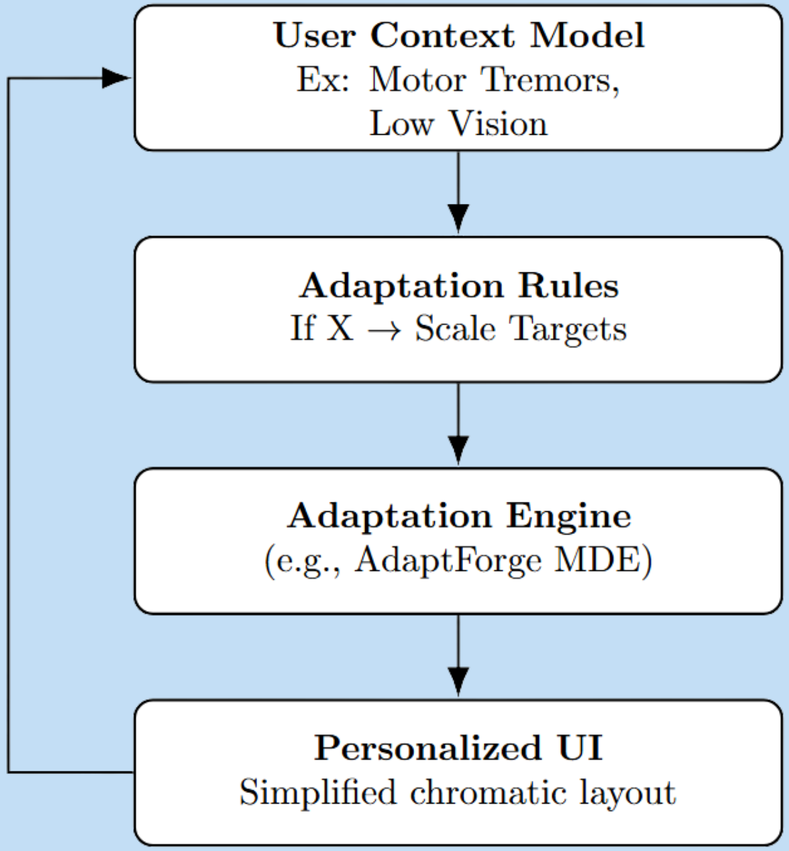
Adaptive Personalization & Macro-Block Architecture



Home Screen:
4 Chromatic Macro-Blocks:

BOOK A VISIT

CONSULT EXAMS

VIEW APPOINTMENTS

REQUEST PRESCRIPTIONS

Binary Decision Tree navigation,
YES / NO only minimizes cognitive load

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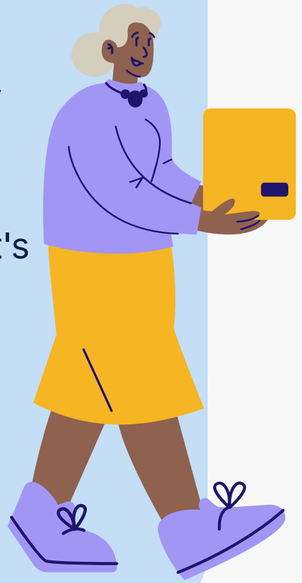
Protecting Autonomy by Design

Pre-Authenticated Hardware Delivery

- No SPID or CIE credentials required for daily access
- One-time in-person provisioning at PA/ASL or certified pharmacy
- Device MAC address linked directly to patient's FSE (Electronic Health Record)
- Device acts as a dedicated cryptographic token. Turning on = authenticated



National Component Standardisation

- AgID (Agenzia per l'Italia Digitale) enforces uniform graphical libraries
- Identical workflow logic regardless of region of residence
- The four chromatic macro-blocks remain consistent nationwide
- Skills learned are fully transferable across regions

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Integrating the Voice Modality

01.

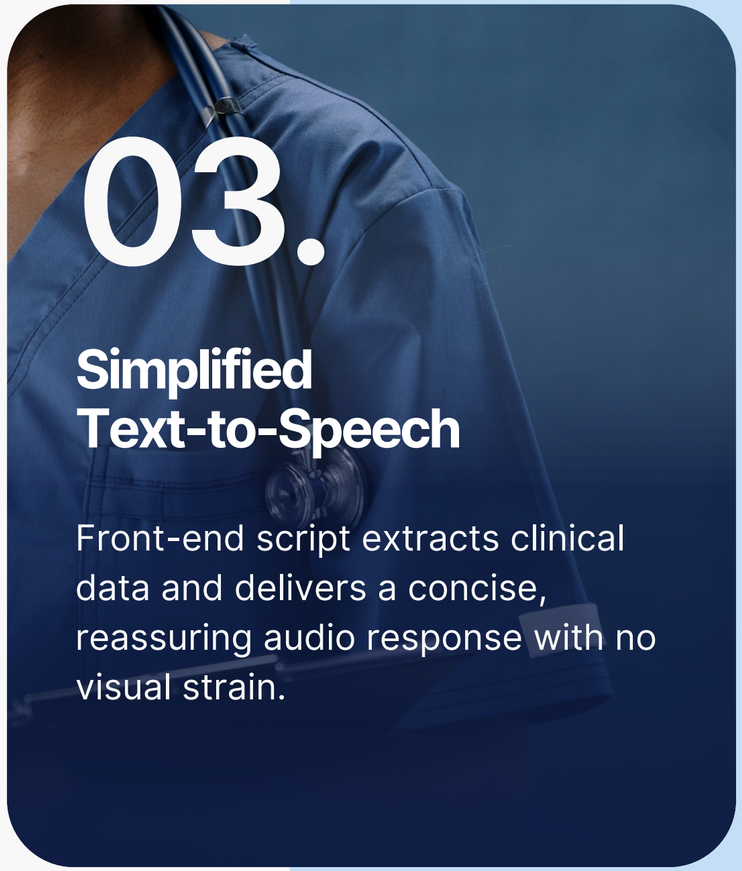
UI Overlay

High-visibility mic icon in global header. Audio channel opens instantly with acoustic + visual feedback.

02.

Speech-to-Text

Local NLP customized for informal phrasing & regional dialects. Maps 'pills for my heart' to a prescription renewal FSE query.



03.

Simplified Text-to-Speech

Front-end script extracts clinical data and delivers a concise, reassuring audio response with no visual strain.

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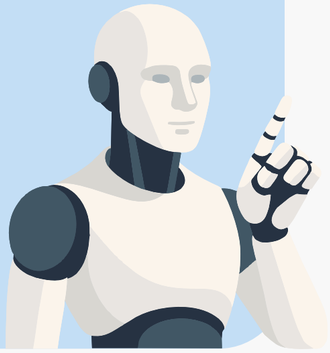
Connecting Voice to AI Agents

Automated Bookings & Safe Triage

- Voice request → background agent checks schedules → appointment booked automatically
- **Hybrid safety net**: if AI is confused or user in distress, transfers to a human operator



Information Summaries Across Apps

- Extends health platform to phone lines and messaging apps (WhatsApp, SMS)
- Agent pulls data from hospital databases and eliminates administrative terminology
- Delivers short, plain-language summaries rather than full medical files

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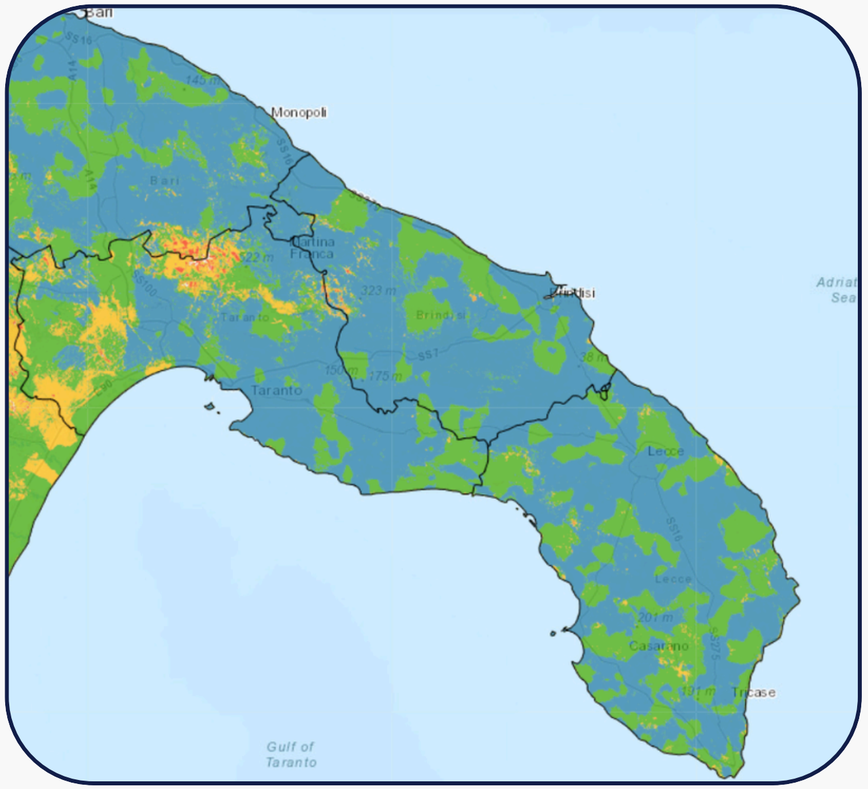
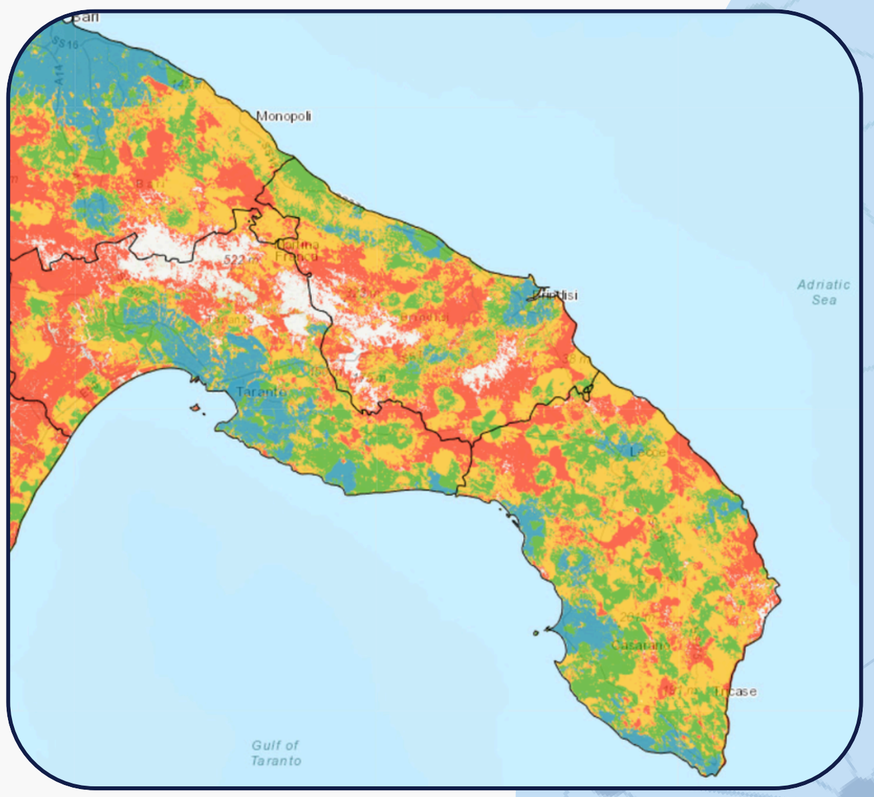
Refinement of the Technology

1
2
3
4



4G coverage (rev. 06/02/2025)



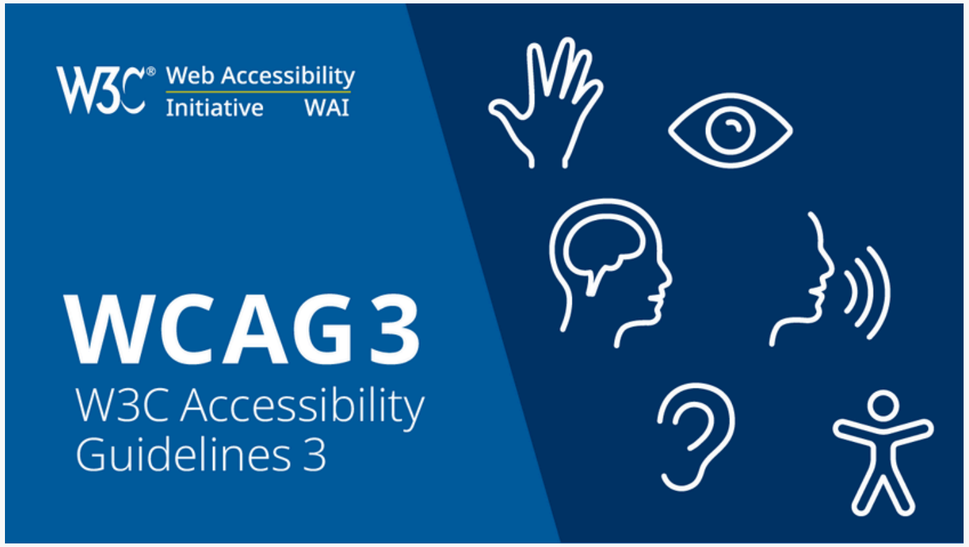
5G coverage (rev. 05/02/2025)

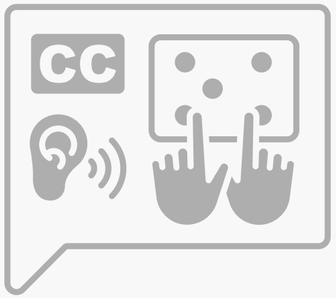
USSD (Unstructured Supplementary Service Data)

MAUVE++

30,000 public websites

762,000 institutional PDFs





1. **Perceivable:** Information and user interface components must be presentable to users in ways they can perceive.
2. **Operable:** User interface components and navigation must be operable.
3. **Understandable:** Information and the operation of the user interface must be understandable.
4. **Robust:** Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies.

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Non-compliance with WCAG standards ranges from 10.1% to 14.7%

Extending the model: Visually Impaired Users

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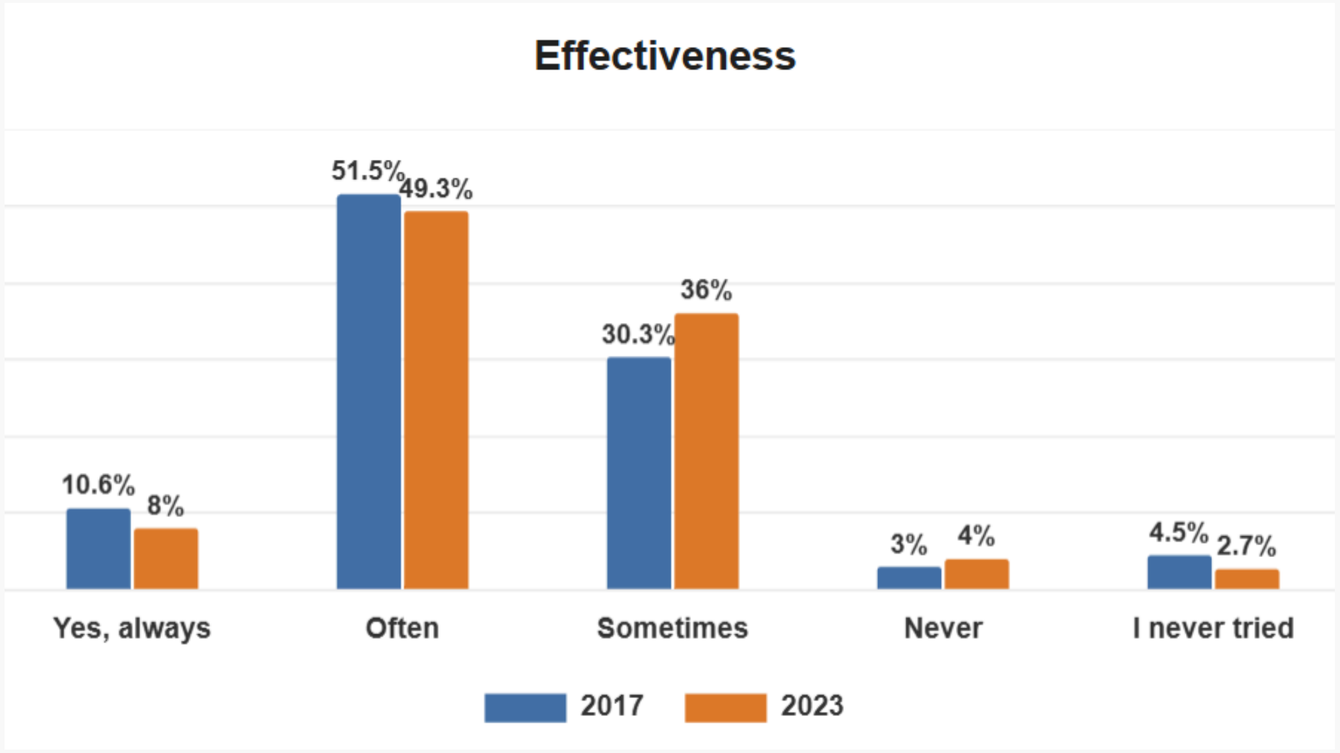
- 89% reported encountering access problems
- 28.9% experience them frequently
- Only 57.3% manage to complete the requested service
- 13.2% find the interaction always very difficult



Extending the model: Migrants, Refugees, and Non-native Speakers

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Procedurally critical sections of institutional portals remain almost exclusively in formal Italian

SPID and CIE authentication presuppose possession of Italian identity documents and a permanent codice fiscale

The progressive mandatory digitalization of public services, accelerated by the PNRR, has raised the linguistic and procedural threshold required

The plain-language reformulation of bureaucratic content and the TTS audio interface — both already embedded in the device to serve elderly users — simultaneously address the linguistic and cognitive barriers faced by foreign-born residents

References

Selected sources for data and graphs presented in these slides. For the full bibliography, please refer to the main paper.

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Thank You!

Diversity Aware Design of Technology Solutions