Connecting the Unconnected

Demystifying interoperability in Digital Public Infrastructure (DPI)

Interoperability can be understood as the digital equivalent of people speaking a common language while retaining their unique accents. Citizens should not have to navigate multiple apps or logins to access public services.



Women navigating an official registration portal in Ramgarh, Jharkhand DEF

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Connecting the Unconnected is a monthly column by the Digital Empowerment Foundation (DEF) that explores how technology can drive inclusion and governance in India. The column focuses on how the digital divide impacts communities differently and advocates for equitable,

citizen-informed solutions that ensure technology empowers rather than excludes.

In today's digital-first world, interoperability has become the cornerstone of effective and inclusive Digital Public Infrastructure (DPI). Yet, it is often treated as a buzzword that is complex, technical, and distant from real-world impact. Moreover, interoperability is rarely discussed in the context of social and cultural integration.

For instance, several digital systems interact seamlessly at a technical level but are not accepted socially or culturally. Take the example of UPI: despite its high usability and robust techno-regulatory framework, it is not widely adopted by all sections of society because of barriers such as lack of access, literacy, affordability issues, and language limitations.

The social reality: Adoption gaps in digital systems

Let us break it down and understand what interoperability truly means, why it matters, and how it shapes the future of digital governance and innovation towards serving the "public." For DPI to be effective, interoperability must translate into services that are accessible, affordable, and convenient for people.

According to available data, out of the 915 million people living in rural India, only about 10% use UPI regularly and successfully. While UPI is a strong example of a DPI component that is interoperable and widely adopted, there is still a long way to go in ensuring meaningful access for all.

Simply put, interoperability is the ability of different systems to communicate and function together seamlessly. In the context of DPI, which includes foundational layers like digital identity, digital payments, and data exchange platforms, interoperability ensures that these systems can share and use information efficiently, regardless of who built them or where they are deployed.

The missing link: Meaningful access

Discussions around DPI, however, often overlook a critical factor: meaningful access. Even if interoperable systems exist, are they truly accessible to people in villages? Can individuals without smartphones or

broadband connectivity use them easily and conveniently? Is DPI available as a public service close to where people live?

Interoperability can be understood as the digital equivalent of people speaking a common language while retaining their unique accents. Citizens should not have to navigate multiple apps or logins to access public services. In fact, they should be able to access these services even without owning a personal device, through local public service access points.

Open, interoperable infrastructure allows startups, governments, and private players to build on shared rails, much like how UPI enabled a vibrant fintech ecosystem in India. Instead of reinventing the wheel, organisations can plug into existing systems. This saves time, reduces costs, and avoids duplication of effort. When systems are designed to interoperate, they can reach citizens across devices, languages, and service providers, ensuring no one is left behind.

Types of interoperability in DPI

Let us briefly discuss types of interoperability in DPI. First, *Technical Interoperability* ensures that systems use common protocols, Application Programming Interfaces, and data formats (e.g., REST APIs, XML/JSON standards). Technical interoperability was a major issue in the early net era (before 2000). With the advent of XML (eXtended Markup Language) and Web Services, the problems posed by binary data exchange were resolved.

The quality of data is of paramount importance in the AI world. Therefore, we need *Semantic Interoperability* that deals with shared understanding of data; for instance, what "Address" or "Transaction ID" means across systems. These are necessary aspects of interoperability.

It also makes sense to introduce two features: *Organisational Interoperability*, which aligns policies, processes, and governance models so that institutions can cooperate effectively; and *Legal and Policy Interoperability* that provides the framework for data sharing, privacy protection, and consent management across entities and borders. The Ministry of Electronics and Information Technology (MeITy) has come up with guidelines for interoperability in e-governance.

India's DPI, known globally as India Stack, embodies interoperability in action. From Aadhaar (digital ID) to UPI (payments) and DigiLocker (document exchange), these platforms are interoperable by design. They have enabled everything from eKYC (Electronic Know Your Customer) for financial inclusion to seamless digital signatures and real-time payments, setting a global benchmark for scalable, citizen-centric digital infrastructure.

Global momentum and the road ahead

Countries across the world – from Singapore and Estonia to nations in Africa and Latin America – are adopting interoperable digital frameworks inspired by the DPI model. Global initiatives like the Digital Public Goods Alliance (DPGA) and G20 DPI principles emphasise open standards, modularity, and interoperability as the key to inclusive digital transformation. Interoperability isn't a one-time achievement; it's an evolving discipline.

As technologies like AI, IoT, and blockchain become integral to public systems, the need for dynamic interoperability, where systems can adapt and evolve together, will define the next phase of DPI. The goal of interoperability is to create a world where digital infrastructure is open, inclusive, and collaborative, empowering innovation across borders.

In summary, interoperability is what transforms digital systems from isolated silos into a connected ecosystem. In DPI, it is not just a technical feature but the philosophy that ensures trust, efficiency, and inclusivity in a digital society where each and every level and class of people can access the DPI without any differentiation or special abilities.

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