ITUPublications

International Telecommunication Union
Standardization Sector

ITU-T Technical Report

(07/2024)

DSTR-DLTUSF

The potential of distributed ledger technology to improve the management of universal service funds

Technical Report ITU-T DSTR-DLTUSF

The potential of distributed ledger technology to improve the management of universal service funds

Summary

This Technical Report explores the use of distributed ledger technology (DLT) for the management of funds in universal service financing projects to enhance transparency and efficiency. The purpose of this technical report is to identify ways to reduce process inefficiency in centralized systems, facilitating the prudent and transparent use of funds and providing a clear and automatic definition of the roles and responsibilities of all stakeholders in the new distributed framework. At the same time, this report also highlights the challenges that comes with new DLT ecosystems such as standardization of DLT frameworks, interoperability and regulatory mechanisms.

Keywords

Distributed ledger technology, universal service funds (USF).

Note

This is an informative ITU-T publication. Mandatory provisions, such as those found in ITU-T Recommendations, are outside the scope of this publication. This publication should only be referenced bibliographically in ITU-T Recommendations.

Change Log

This document contains Version 1 of the ITU-T Technical Report DSTR-DLTUSF on "Use of Distributed Ledger Technology to Improve the Management of Universal Service Funds" approved at the ITU-T Study Group 3 meeting held in Geneva, 9-18 July 2024.

Editor:	M.C. Sathish Department of Telecommunications India	E-mail: mcsathish@gov.in
	Pauline Tsafak Djoumessi Gnimpieba Ministry of Posts & Telecommunications Cameroon	E-mail: pauline.tsafak@minpostel.gov.cm
	Ankit Verma Ministry of Communications India	E-mail: verma.ankit@gov.in

Table of Contents

Technical Report ITU-T DSTR-DLTUSF

The potential of distributed ledger technology to improve management of universal service funds

1 Scope

In order to enable people living in rural and disadvantaged areas to access, inter alia, international telecommunications, several countries have established universal service funds to support both investment and access in these areas. The efficient management of this fund is necessary for the successful implementation of universal service fund (USF) projects. In this context, this report examines the use of distributed ledger technology to ensure better management of the USF, particularly in developing countries, where inefficiencies exist in centralised fund management.

2 References

[1] OECD. (2008). *OECD Glossary of Statistical Terms* (), Definition of universal service (Pg. 567), https://www.oecd.org/content/dam/oecd/en/publications/reports/2008/09/oecd-glossary-of-statistical-terms_g1gh9ad7/9789264055087-en.pdf .

[2] ITU DataHub. (n.d.). https://datahub.itu.int/

[3] Federal Communications Commission (FCC). (2022). *FCC Reports to Congress on Future of the Universal Service Fund*, https://www.fcc.gov/document/fcc-reports-congress-future-universal-service-fund.

[4] International Telecommunication Union. (2013). *Universal service fund and digital inclusion for all*. https://www.itu.int/en/ITU-D/Digital-Inclusion/Documents/USF_final-en.pdf

[5] Communications Authority of Kenya. (n.d). *Opportunities and challenges of using universal service fund*, https://www.itu.int/en/ITU-D/Conferences/WTDC/WTDC17/RPM-AFR/Documents/presentations/USF_Challenges_and_Opportunities_Kenyan_Experience.pdf

[6] NITI Aayog. (2020). *Blockchain: The Indian Strategy*, https://niti.gov.in/sites/default/files/2020-01/Blockchain_The_India_Strategy_Part_I.pdf

[7] Ankit Verma, *Use of Smart Contract Embedded Distributed Ledger Technology for Subsidy Disbursement from USOF* (2020, Pg. 62) in 23rd National Conference for e-Governance. https://nceg.gov.in/assets/pdf/Compendium_Booklet_23rd_NCeG.pdf

[8] International Telecommunication Union. (2019). *Distributed ledger technologies: Use cases*. https://www.itu.int/pub/T-TUT-DLT-2019-UC

[9] International Telecommunication Union. (2019). *Distributed ledger technologies: Regulatory framework.* https://www.itu.int/pub/T-TUT-DLT-2019-RF

[10] International Telecommunication Union. (n.d.). *Universal Service Financing Efficiency Toolkit*. https://www.itu.int/itu-d/reports/regulatory-market/usf-financial-efficiency-toolkit/

[11] International Telecommunication Union. (n.d.). *Universal Service Financing: Countries with an operational universal service fund (USF).* Data explorer – ITU DataHub. https://datahub.itu.int/data/?i=100093&s=3183

3 Definitions

3.1 Terms defined elsewhere

None.

3.2 Terms defined in this Technical Report

None.

4 Abbreviations and acronyms

This Technical Report uses the following abbreviations and acronyms:

DLT Distributed Ledger Technology

PMC Project Management Charges

SLA Service Level Agreement

USF Universal Service Fund

USOF Universal Service Obligation Fund

USP Universal Service Provider

5 Introduction

"Universal Service" is a long-held, fundamental concept found in most national telecommunications policy frameworks whereby every individual within a country should have a basic telephone service available at an affordable price [1]. Important changes have taken place in universal service among many ITU Member States, where market liberalization and technological developments in the telecommunications sector have resulted in improvements in telecommunications availability (through increased penetration of fixed line and wireless as well as enhanced quality of service), affordability (through lower prices, in overall terms, and through pre-paid mobile services) and accessibility (improved through voluntary but also through regulatory schemes). As a result, there has been significant progress by countries in meeting their national universal service goals.

Universal service obligation fund (USOF), universal service fund (USF), universal service fund company, telecommunication development fund and various other such terms are used to designate the actual mechanism used to fund universal service mechanisms in different countries. The overall objective of a USF is to connect (often sparsely populated rural and remote) areas of a country where providing telecommunication services is not financially viable for private telecom service providers or Internet service providers. In principle, a USF could be financed through several means; for example, a direct levy on all consumers of communication services (for example, a fixed amount that appears directly on the bill); a direct or indirect levy on consumers (via a levy on communication providers that is passed on to customers), funding from the proceeds of privatization and spectrum license fees or government funding via general taxation revenue.

USF, then, is a mechanism for ensuring that these contributions made are put toward market developments that will benefit citizens, and that will create new business opportunities for telecommunication companies and content providers alike. Properly administered, a USF serves as a collective investment mechanism for the telecommunication industry as a whole, and provides a 'win-win' situation for both industry and society by developing new markets and ensuring wider access to the social benefits of connectivity efforts.

Many governments wishing to provide telecommunication services to those who are unconnected have chosen the USF as the principal policy instrument. However, there is evidence that monies directly or indirectly collected from users of telecommunication services are lying unspent in these funds. Two metrics, the total disbursement rate and the year-on-year disbursement rate, can be used to assess the disbursement efficacy of universal service programs.

Based on the ITU Data Hub, as of 2022, 49 percent of the countries have operational USFs. The table below shows the region-wise status of USFs.

Table 1 – Countries with an operational USF (Source: ITU Data Hub)

Sl. No.	Economy	Status
1	Africa	70.50%
2	Arab States	54.60%
3	Asia & Pacific	52.50%
4	CIS	33.30%
5	Europe	17.40%
6	The Americas	60%
7	World	49%

Certainly, any improvement in efficiency and increased effectiveness in the administration of a given national USF will contribute to successful public policy outcomes of a national universal service program, and thus is particularly important to improving the socio-economic parameters of rural and remote areas in any country.

With the advancement of technology, distributed ledger technology (DLT) provides an additional potential protocol to build upon the current system of subsidy disbursement from USFs.

DLT is defined as an incorruptible digital ledger of economic transactions that can be programmed to record not just financial transactions **but virtually everything of value** *(Don & Alex Tapscott, authors Blockchain Revolution (2016))*. "**Things of Value**" in the context of USF are information (i.e., a specific set of metrics) and efficient fund movement. Accountability and transparency are also widely considered to be "success factors" in the management of USFs. This Technical Report recognizes various challenges in the current administration of USFs and provides an insight into ways in which DLT can potentially increase transparency and accountability to these systems through its core characteristics of immutability, decentralization, encryption and trust-building. It is important to consider the functional requirements for incorporating DLT in the present workflow and the possible reengineering of current processes. Therefore, before migrating to DLT, certain policy and regulatory aspects in relation to a USF might need to be revisited. Procedure and precaution are also needed to move from current legacy systems governing USFs to this new technology.

This report considers various challenges faced in the current administration of USF in countries, along with the role of stakeholders involved in it. Further, it enumerates several core characteristics of USF which are relevant to tackling these challenges and thereby improving its effectiveness and efficiency.

6 Administration of USF

In developing any study of USF approaches, it is important to note that any specific national USF is dependent on domestic policies where each Member State must define a basic telecommunication service by specifying which technologies must be universally available. For example, according to the ITU Telecommunication/ICT Regulatory Survey, almost 39 per cent of Member States consider mobile telephony as an essential technology to be supported under the USF framework. Such support has been increasing annually as demonstrated in Figure 1 below:

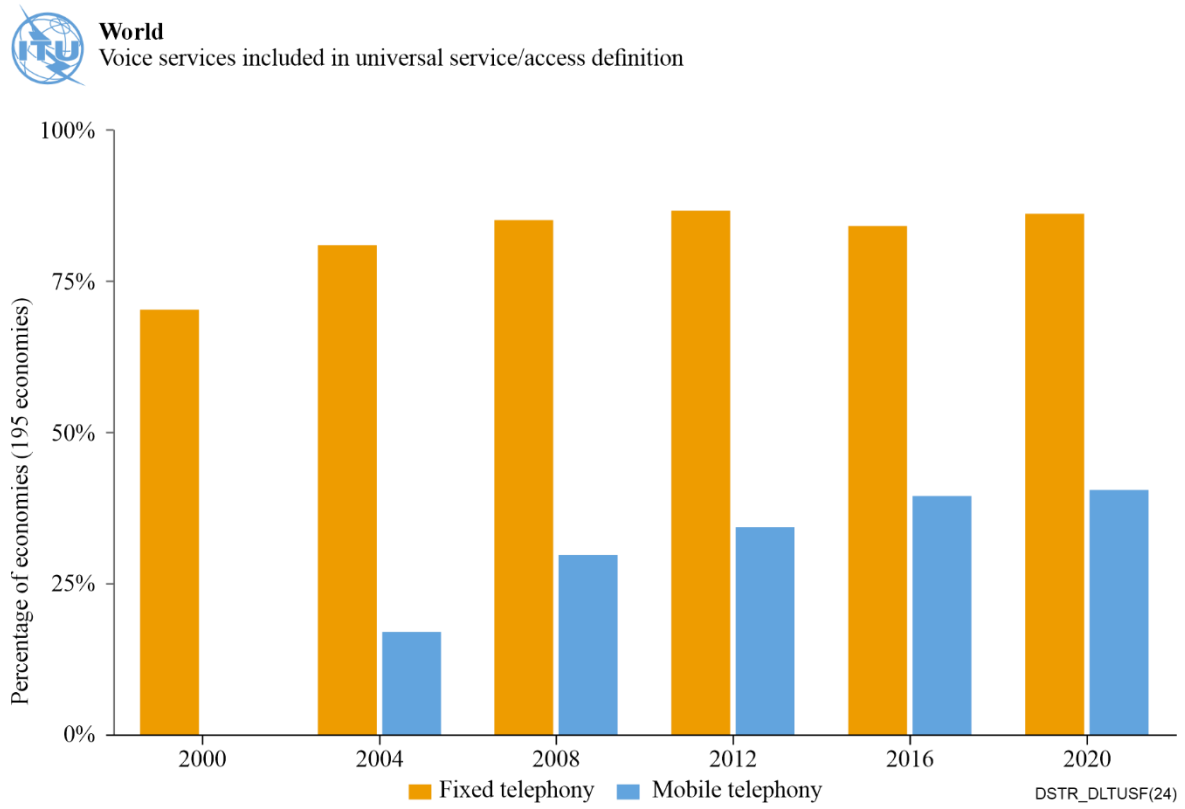

Figure 1 – Voice services included in universal service definition

In addition, the continued success of any country's USF in meeting its policy goals is predicated on sustained and frequent review of its overall universal service programs in the context of both the communication needs of its citizens and the evolution of technology (and technological convergence) over time. As an example, in August 2022, the U.S. Federal Communications Commission (FCC) adopted a report on the future of the universal service fund (required by the U.S. Congress) with options for improving its effectiveness in achieving universal service goals for broadband. The report provided recommendations for further actions by the FCC to build upon the recently-allocated investment for broadband and improve the ability of the FCC to achieve its goals of universal deployment, affordability, adoption, availability and equitable access to broadband through the USF and other Commission programs, to ensure that all individuals will have access to communication services "needed to succeed and thrive" [3].

There are many practical challenges encountered in the ongoing operation and management of national USFs, including clearly defining the overall USF strategy, scope and objectives, and addressing issues that may arise given changes in countries' underlying legal and regulatory frameworks. Changes in the economic viability of the basic fund design and on-going potential impediments to its disbursement and management also demand continuous analysis over time. Thus, the potential use of DLT is one important area to consider in order to assist countries in their improved implementation of their national USFs.

Figure 2 illustrates the USF framework in India and the complexity involved in its administration.

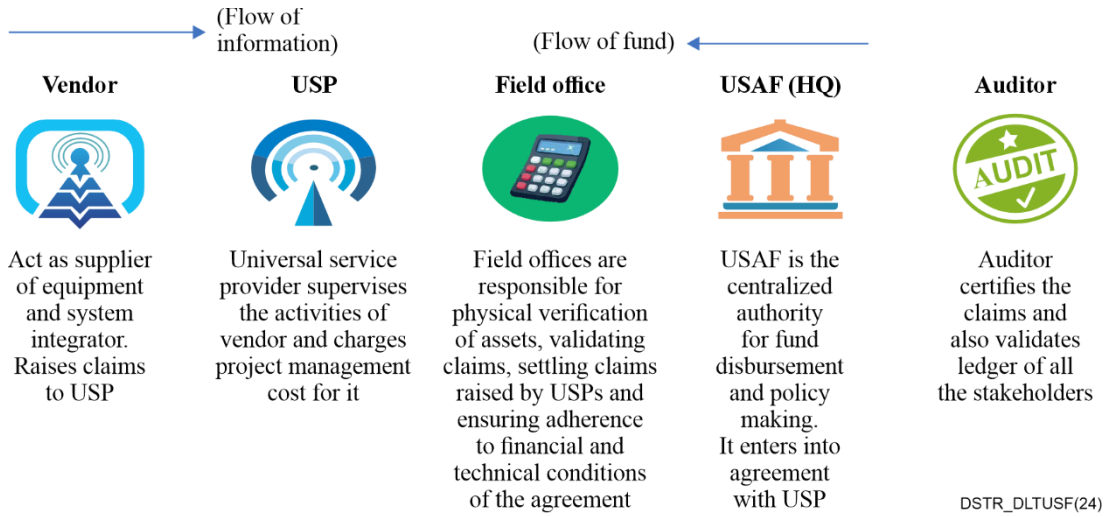

Figure 2 – Current state of disbursement process from USOF in India

7 Specific challenges of USF administration

Recent studies indicate that the administration of USF poses the following challenges:

1. Underutilization of fund: As indicated earlier, only 49 per cent of the countries have operational Universal Service Funds, as at 2022. Further, only 22.5 per cent of the economies are using USF as financing mechanism for universal access. Earlier, in 2013, the ITU published a report which showed around 36 per cent USF with inactivity to low activity in terms of disbursement of fund. USF forms approximately 1-2 per cent of the GDP of a country. Such under-utilization has an opportunity cost associated to it. [4]
2. Errors in fund administration: Inconsistency in the implementation of subsidy disbursements, opaque fund governance, etc.
3. Delay in programmatic execution: Delays in tendering processes result in the awarding and executing of USF contracts. Similarly, other steps involved in USF management (e.g., fund disbursement, procurement, etc.) are prone to delay, and therefore result in cost overruns [5].
4. Other challenges: As per the Universal Service Financing Toolkit prepared by ITU-D, some of the factors which were highlighted as reasons for the failure of USF are:
   a. levies are set without any analysis of the subsidy levels needed;
   b. many funds suffer from low human capacity and poor or inefficient administration;
   c. transparency for most funds is inadequate – for example, with no set targets, no audits, no periodic reports published;
   d. underlying legal frameworks tend to be poorly-conceived and thus affected by the lack of technological neutrality, lack of service-flexibility, excessively bureaucratic structure or insufficient oversight.

8 Overview of distributed ledger technology

DLT is a trusted digital platform which rests on the creation of a shared and verifiable ledger among various stakeholders involved in any business transactions. This ledger is stored at various nodes (stakeholders) in the network. DLT can be of public/permissionless or private/permissioned configuration which each have its unique advantages and disadvantages. However, in the case of limited nodes with pre-defined roles (such as in supply chain management) the private/permissionless configuration is preferred, contingent on proof-of-authority as a consensus mechanism. Some of the core attributes of DLT which makes it suitable for creating a digital platform for fund disbursement from USF are as follows:

a) **Immutability**: Any transactions made are permanently recorded and are linked to transactions that came before them in the chain. This makes it append only ledger entries which cannot be changed retrospectively. This immutability characteristic provides a solid foundation for FinTech applications like payment/settlement. The money transfer logs store transfers of funds from the USF headquarters to field offices for subsequent payment of project management charges to universal service providers (USPs) and to vendors for asset creation/maintenance. This acts in tandem with provenance. Recording transactions (information/fund) that leaves an audit trail, hence improving the traceability of any transaction. It also helps in facilitating the audit process.

b) **Distributed**: The identical ledger is shared across the network amongst nodes. This contrasts with current systems where every stakeholder (e.g., universal service providers, vendors, etc.) maintains their own ledger, potentially creating information asymmetry. Hence, a distributed characteristic provides for a "single source of truth" which can be certified by auditors. Further, being distributed in nature provides for multiple points of failure against any centralized data breach that can occur, as each node in the network has the same and real-time updated copy of the ledger.

c) **Transparency**: By recording and maintaining all the activities that take place in the system in such a distributed architecture, transparency is increased for all parties involved in the system.

d) **Encrypted**: The use of an encrypted distributed ledger maintains data integrity and further adds a trust value to any transaction.

Some examples of use cases of DLT:

a) The state of Bahia in Brazil has launched a DLT-based solution known as Bid Solution to track the public bidding process on government contracts.

b) Currently NITI Aayog, Government of India in collaboration with Gujarat Narmada Valley Fertilisers & Chemicals (GNFC) is working on the creation of a fertilizer subsidy disbursement framework using Blockchain. [6]

DLT is an evolving technology with its own inherent challenges, specifically, interoperability with the existing process and infrastructure, the lack of customized policy guidelines and standards needed in specific use cases, and the legal underpinning for DLT implementation.

9 The use of distributed ledger technology in the universal service fund ecosystem

Universal service funds are disbursed to universal service providers (USPs) to provide telecommunication infrastructure in rural and remote areas. Disbursement from USF involves multiple transactions amongst stakeholders.

Some of the transactions required are listed as follows:

a) Subsidy claims: The difference between capital and operation expenditure and revenue generated is provided as "gap funding" to USPs. These claims are verified by various governmental or quasi-governmental agencies or offices (field offices, USF Boards, auditors, etc.). Transactions takes place between the USF headquarter to field offices to executing agencies to implementing agencies to vendors, in sequence. Further, there are various deductions/recoveries like liquidation damages and penal charges, based on the specific Service Level Agreement (SLA).

b) Project management charges: The executing agency charges a fee for the execution of the project.

c) Third party audit: The deployment of infrastructure often has to undergo a quality assessment and certification of assets as per the terms and conditions of the SLA, etc. These operations often have agency expenses recouped as fee-for-services.

Such transactions can be recorded on a common digital platform with all the stakeholders having a defined role within the private DLT. The consensus mechanism will be proof-of-authority. Examples of roles of nodes may include:

a) USF (headquarter): Acts as the system administrator and as a de facto "gatekeeper" for dispute resolution, defining the access level of different nodes, standard-setting for invoices, claims, etc.

b) Vendors: Asset creation and registration on the DLT platform.

c) Executing agency: Certifying the asset created and raising claims in field offices.

d) Field offices: Validating claims and intimation to the USF with fund requisition.

e) Auditor: To view claims but not to update blocks.

A simplified flow chart of this process is shown in Figure 3 below: [7]

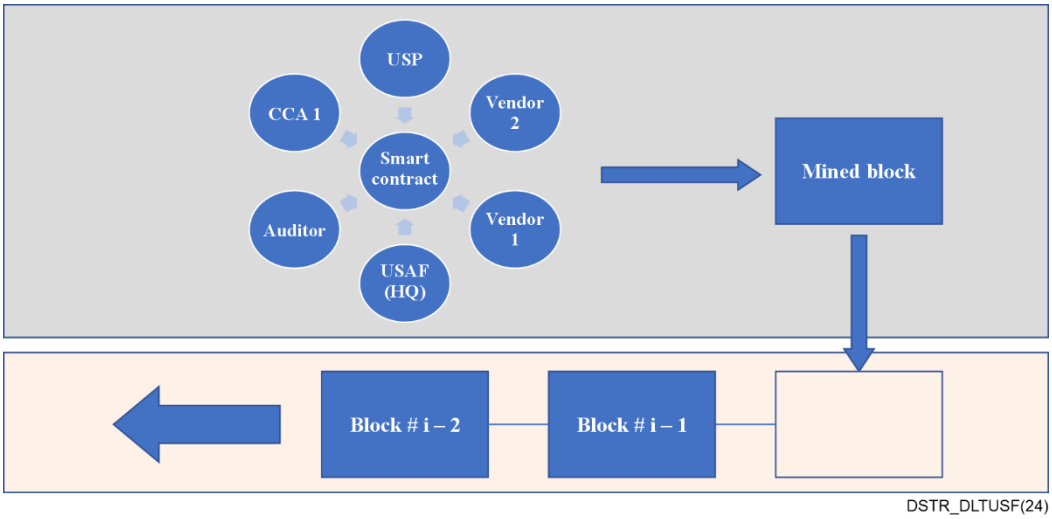

Figure 3 – Proposed DLT process flow

Execution of subsidy disbursement through DLT offers various advantages such as less time for settlement of claims, reduced effort in reconciliation of accounts maintained by various stakeholders, less possibility of administrative error, more objectivity in the process, improved traceability of internal processes undertaken, etc. However, a transition to a DLT-based system may need to take into account the following pre-requisites and challenges:

a) Standardization: Standards would need to be created for data-sharing amongst nodes, authorization level of nodes, correction error in transactions, etc. Standards development organizations such as IEEE have existing standards on blockchain that could be leveraged.

b) Interoperability with legacy systems: Currently, administration of USF is often carried out in a non-digital manner. Such legacy systems require re-engineering for migration to a DLT platform.

c) Regulatory mechanisms: At the domestic level, each Member State should consider the regulatory mechanisms required for dispute resolution and for conformance and compatibility to existing national law and regulations.

10 Concluding remarks

USF helps population groups with a low income or living in rural areas which are remote or difficult to access to have greater access to national and international telecommunication services. However, when the management of a USF is not optimal, the objectives set cannot always be attained. This report highlights the potential use of DLT to improve USF management by remedying problems

related to external interference, delays in the tendering process, inequality in the distribution of funds for project implementation and the fund management structure.

DLT is a technological tool which is intrinsically neutral, but it can be used both for good and illicit activities and the key issue is to find proper ecological niches for this technology. The financing efficiency is a core criterion for the success of any fund, especially for funds such as USF which are used for public good. The DLT has potential to increase the efficiency by removing the dependencies in traditional manual process such as intermediaries and to expedite the payments process flow with automated and secured features. The opportunities provided by DLT should also be considered with challenges such as standardization of DLT frameworks, interoperability and regulatory mechanisms.