

Draft new Supplement to ITU-T Y.2345 series (Y.Suppl.UC-NRS-DLT)

Use cases of network resource sharing based on distributed ledger technology for supporting large-scale deep learning models

Summary

This Supplement aims to specify motivations and necessities of network resource sharing based on DLT (NRS-DLT) for supporting large-scale deep learning models.

The scope of this Supplement includes:

- General considerations;
- Use cases of NRS-DLT for supporting large-scale deep learning models.
- Network expectations of NRS-DLT for supporting large-scale deep learning models.

Keywords

network resource sharing, large-scale, deep learning models

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1. Scope

This Supplement aims to specify motivations and necessities of network resource sharing based on DLT (NRS-DLT) for supporting large-scale deep learning models.

The scope of this Supplement includes:

- General considerations;
- Use cases of NRS-DLT for supporting large-scale deep learning models.
- Network expectations of NRS-DLT for supporting large-scale deep learning models.

2. References

The following ITU-T Recommendations and other references contain provisions which, through reference in this text, constitute provisions of this Supplement. At the time of publication, the editions indicated were valid. All Recommendations and other references are subject to revision; users of this Supplement are therefore encouraged to investigate the possibility of applying the most recent edition of the Supplements and other references listed below. A list of the currently valid ITU-T Recommendations is regularly published.

The reference to a document within this Supplement does not give it, as a stand-alone document, the status of a Recommendation.

[ITU-T Y.2345] Recommendation ITU-T Y.2345, "Scenarios and requirements of network resource sharing based on distributed ledger technology"

[ITU-T Y.AN-Arch-fw] Recommendation ITU-T Y.NRS-DLT-arch: "Functional architecture of network resource sharing based on distributed ledger technology"

3. Definitions

3.1 Terms defined elsewhere

This Supplement uses the following terms defined elsewhere:

3.1.1 distributed ledger [ITU-T X.1400]: A type of ledger that is shared, replicated, and synchronized in a distributed and decentralized manner.

3.1.2 Deep learning model [ITU-T F.748.12]: A deep learning algorithm used to solve a specific task, usually refers to the computational graph structure information and parameter information used to represent the deep learning algorithm.

TBD

3.2 Terms defined in this document

This Supplement defines the following terms:

3.2.1

TBD

4. Abbreviations and acronyms

This Supplement uses the following abbreviations and acronyms:

DLT Distributed Ledger Technology

NRS-DLT Network Resource Sharing Based On DLT

TBD

5. Conventions

In this Supplement:

The keywords "is required to" indicate a requirement which must be strictly followed and from which no deviation is permitted, if conformance to this Supplement is to be claimed.

The keywords "is recommended" indicate a requirement which is recommended but which is not absolutely required. Thus, this requirement need not be present to claim conformance.

The keywords "can optionally" indicate an optional requirement which is permissible, without implying any sense of being recommended. This term is not intended to imply that the vendor's implementation must provide the option, and the feature can be optionally enabled by the network operator/service provider. Rather, it means the vendor may optionally provide the feature and still claim conformance with this Supplement.

6. General considerations of NRS-DLT for large-scale deep learning models

6.1 NRS-DLT

Network resource sharing is the system that support the users of different networks to share the network resource among networks as business demands, including sharing computing, storage, connection and data resource. NRS-DLT is distributed network resource sharing which supports traditional network system interaction and provides DLT related capabilities among various network entities by utilizing DLT as a data carrier for resource status, for allocating computing, storage and network resources of infrastructure layer and network layer to applications [ITU-T Y.2345 (ex Y.NRS-DLT-reqts)].

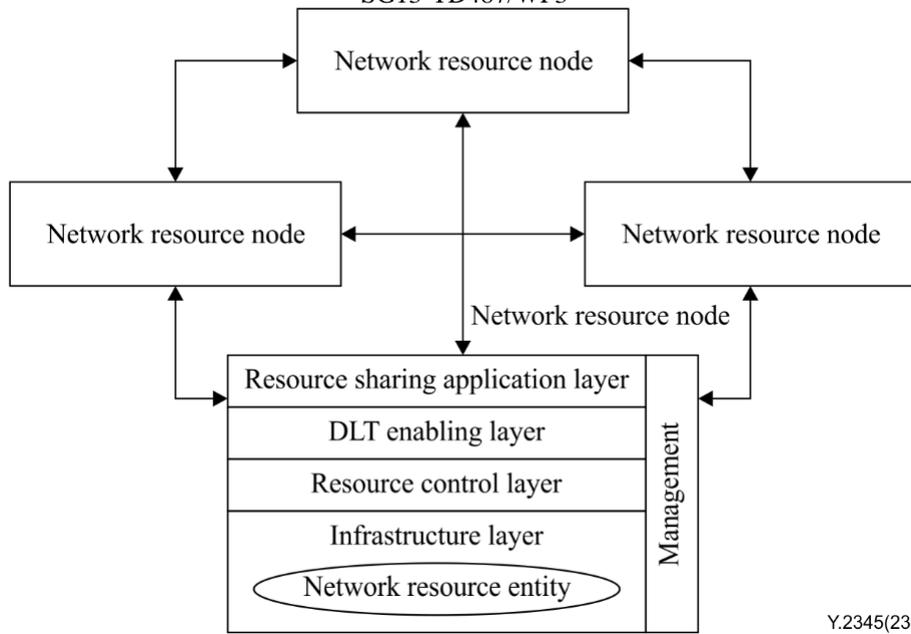


Figure 6-1 – General framework of network resource sharing based on distributed ledger technology

6.2 Large-scale deep learning model

Deep learning model is a deep learning algorithm used to solve a specific task, usually refers to the computational graph structure information and parameter information used to represent the deep learning algorithm [ITU-T F.748.12 (06/2021)]. State-of-the-art deep learning models that power important applications such as web search, have seen a rapid growth in number of model parameters.

Large-scale deep learning models refers to those models with billions of parameters, exceeding the capacity of a single device.

TBD

6.2 Overview of NRS-DLT for Large-scale deep learning model

In recent years, there has been rapid development in deep learning models. However, the training and deployment of large-scale deep learning models pose significant challenges as they require extensive network resources, which are only available to a select few organizations. Accelerating the training process and reducing the cost of large-scale deep learning models have become active areas of research. To address these challenges, researchers are exploring various methods and technologies, such as using more efficient algorithms, optimizing model architectures, leveraging distributed network resources, and more.

On the other hand, decentralization is a natural and promising direction. Since many network resources are underutilized, utilizing these network resources in a decentralized open-volunteering paradigm for deep learning models training would be a revolutionary alternative to the expensive solutions offered by data centers.

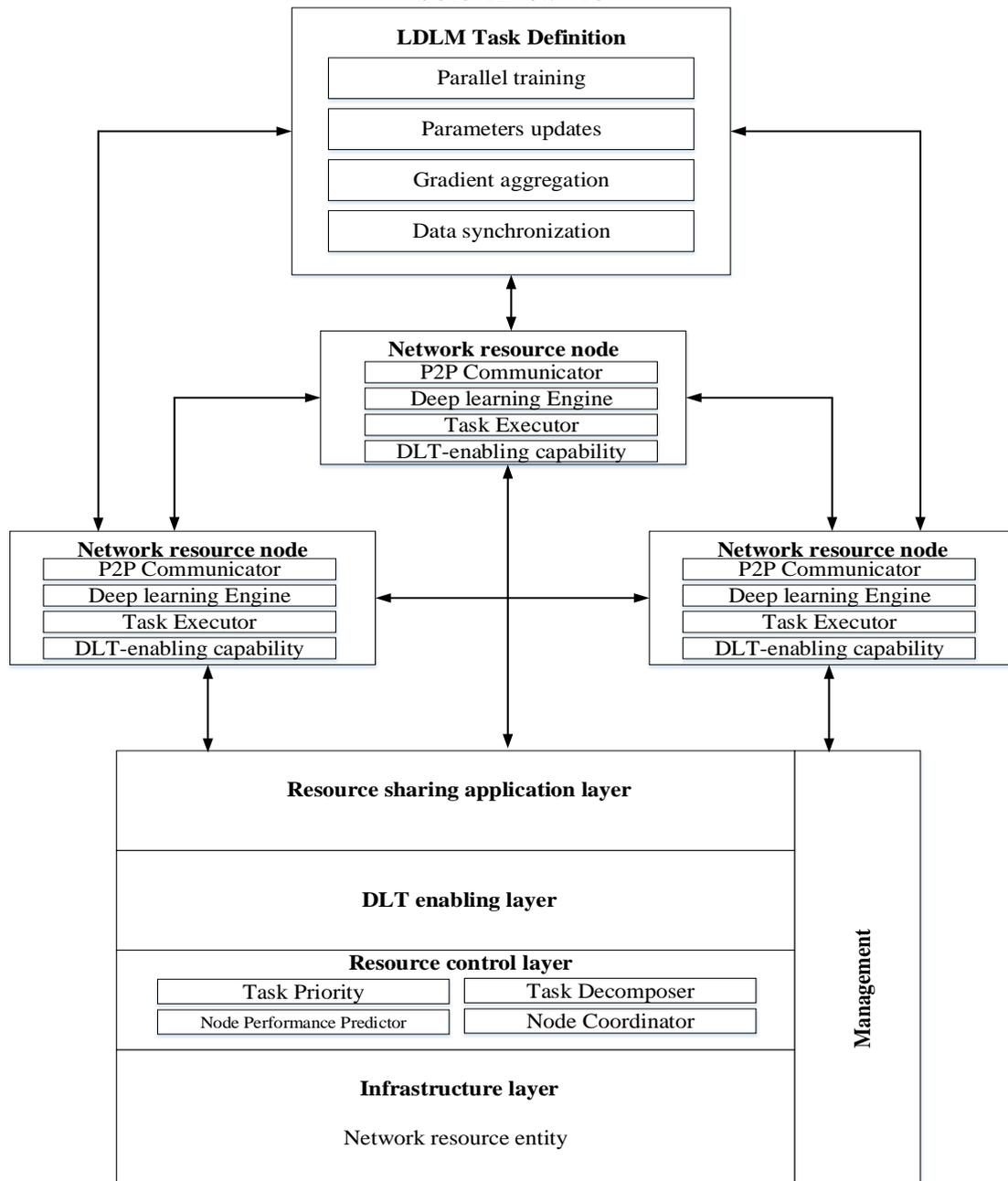


Figure 6-2 – General framework of NRS-DLT for large-scale deep learning models

TBD

7. Use cases of NRS-DLT for large-scale deep learning models

Editor's Note: This clause presents the use cases of NRS-DLT for large-scale deep learning models.

7.1 Heterogeneous network resource sharing

TBD

7.2 Network resource scheduling optimization

TBD

7.3 High-efficiency data synchronization

TBD

7.4 Validation for the completion of the distributed model training task

TBD

8. Expectations of NRS-DLT for large-scale deep learning models

Editor's Note: This clause specifies the network expectations of NRS-DLT for supporting large-scale deep learning models.

8.1 General expectations of NRS-DLT for large-scale deep learning models

TBD

8.2 Expectations on network resource scheduling optimization

TBD

8.3 Expectations on data synchronization

TBD

8.4 Expectations on task validation

TBD

8.5 Expectations on heterogeneous network resource sharing

TBD

TBD

Attachment 1

A.13 justification for proposed draft new ITU-T Y.Suppl.UC-NRS-DLT Supplement to Y.2345: “Use cases of network resource sharing based on distributed ledger technology for supporting large-scale deep learning models”

Question:	Q2/13	Proposed new ITU-T Supplement	Geneva, 4 - 15 March 2024
Reference and title:	ITU-T Y.Suppl.UC-NRS-DLT Supplement to Y.2345“Use cases of network resource sharing based on distributed ledger technology for supporting large-scale deep learning models”		
Base text:	SG13-TD487/WP3	Timing:	2025-Q2
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<p>Scope (defines the intent or object of the Supplement and the aspects covered, thereby indicating the limits of its applicability):</p> <p>This Supplement aims to specify motivations and necessities of network resource sharing based on DLT (NRS-DLT) for supporting large-scale deep learning models.</p> <p>The scope of this Supplement includes:</p> <ul style="list-style-type: none"> • <input type="checkbox"/> General considerations; • <input type="checkbox"/> Use cases of NRS-DLT for supporting large-scale deep learning models. • <input type="checkbox"/> Network expectations of NRS-DLT for supporting large-scale deep learning models. 			
<p>Summary (provides a brief overview of the purpose and contents of the Supplement, thus permitting readers to judge its usefulness for their work): To be simplified to concise key aspects.</p> <p>In recent years, there has been rapid development in deep learning models. However, the training and deployment of large-scale deep learning models pose significant challenges as they require extensive network resources, which are only available to a select few organizations. Large-scale deep learning models refers to those models with billions of parameters, exceeding the capacity of a single device. Through the decentralized scheme, the training process of large-scale deep learning models can be significantly accelerated and the cost can be reduced. To fulfill the potential of decentralization for the training of large-scale deep learning models, it is necessary to supplement the framework of NRS-DLT to supporting large-scale deep learning models.</p> <p>This new Supplement aims to provide the general considerations, use cases and network expectations of NRS-DLT for large-scale deep learning models.</p>			
<p>Relations to ITU-T Recommendations or to other standards (approved or under development):</p> <p>ITU-T Y.2345, ITU-T F.748.12, ITU-T Y.NRS-DLT-arch</p>			
<p>Liaisons with other study groups or with other standards bodies:</p> <p>ITU-T SG16, ISO/IEC JTC1 SC42, 3GPP TSG SA, ETSI ENI,</p>			
<p>Supporting members that are committing to contributing actively to the work item:</p> <p>China Telecom, Huawei, China Unicom</p>			