YesDR Technical Specification

YesDR TS 02.003

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Release 1

YesDR User Plane Function (YUPF)

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1 Scope

This Technical Specification defines the YesDR User Plane Function (YUPF).

YUPF is responsible for user-plane packet forwarding, GTP-U tunneling, traffic usage measurement, and enforcement of policy and charging rules under the control of the YesDR Session Management Function (YSMF).

YUPF is conceptually aligned with the 3GPP User Plane Function defined in TS 23.501 and TS 29.244.

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2 References

2.1 Normative References

- YesDR TS 01.001: YesDR Overall Architecture
- YesDR TS 02.001: YesDR Core Network Functions
- YesDR TS 02.002: YesDR Session Management Function (YSMF)

2.2 Informative References

- 3GPP TS 23.501: System Architecture for the 5G System
- 3GPP TS 29.244: Packet Forwarding Control Protocol (PFCP)

3 Definitions, Symbols, and Abbreviations

Abbreviation	Description
YUPF	YesDR User Plane Function
YSMF	YesDR Session Management Function
PFCP	Packet Forwarding Control Protocol
GTP-U	GPRS Tunneling Protocol – User Plane
TEID	Tunnel Endpoint Identifier
SEID	Session Endpoint Identifier
PCC	Policy and Charging Control
DN	Data Network

4 Functional Overview

YUPF performs the following functions:

- GTP-U encapsulation and decapsulation
- Uplink and downlink packet forwarding
- PFCP session establishment, modification, and deletion
- Traffic usage measurement and reporting
- Enforcement of policy-based traffic control

YUPF SHALL operate under the control of YSMF using PFCP.

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5 YUPF Architecture

YUPF consists of the following logical components:

- PFCP control-plane server
- GTP-U user-plane forwarding engine
- Session state database
- Usage monitoring and reporting module
- NRF registration and heartbeat client

YUPF SHALL register itself with YNRF and maintain liveness via periodic heartbeat messages :contentReference[oaicite:1]index=1.

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6 Session State Management

Each YUPF session SHALL maintain the following parameters:

Parameter	Description
UPF-SEID	Unique session identifier at YUPF
CP-SEID	Control-plane session identifier
UE IP Address	Assigned UE IPv4 address
gNB IP Address	Serving access node IP
Uplink TEID	GTP-U TEID for uplink traffic
Downlink TEID	GTP-U TEID for downlink traffic
Used Bytes	Accumulated traffic volume
Report Threshold	Usage threshold for reporting
PCC Rules	Policy enforcement parameters

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7 PFCP Procedures

7.1 PFCP Association

YUPF SHALL support PFCP association setup and heartbeat procedures as defined in TS 29.244.

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7.2 PFCP Session Establishment

Upon receiving a PFCP Session Establishment Request, YUPF SHALL:

1. Allocate a UPF-SEID
2. Extract PDI information (UE IP, F-TEID)
3. Allocate GTP-U TEIDs
4. Create session state
5. Respond with PFCP Session Establishment Response

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7.3 PFCP Session Modification

YUPF SHALL support session modification to:

- Apply PCC rules (e.g., maximum bit rate)
- Update reporting thresholds

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7.4 PFCP Session Deletion

Upon receiving a PFCP Session Deletion Request, YUPF SHALL release all associated session resources.

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8 GTP-U Procedures

YUPF SHALL:

- Decapsulate uplink GTP-U packets from the access network
- Forward inner IP packets to the data network
- Encapsulate downlink packets using GTP-U
- Forward downlink packets to the access network

Policy enforcement (e.g., traffic throttling) SHALL be applied prior to downlink transmission.

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9 Usage Measurement and Reporting

YUPF SHALL measure traffic volume per session.

When the accumulated traffic exceeds the configured reporting threshold, YUPF SHALL generate a PFCP Session Report Request toward YSMF, including the measured usage volume.

After reporting, the usage counter MAY be reset.

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10 Policy Enforcement

YUPF SHALL enforce policy decisions received from YSMF, including:

- Maximum bit rate enforcement
- Traffic blocking
- Dynamic throttling

Policy enforcement SHALL apply to both uplink and downlink traffic.

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11 Security Considerations

YUPF SHALL:

- Validate PFCP message integrity
- Protect session state and usage data
- Restrict unauthorized GTP-U traffic

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12 Relationship to 3GPP UPF

YUPF aligns with the functional behavior of the 3GPP UPF while:

- Supporting SDR-based research deployments
- Allowing simplified PFCP encoding
- Enabling experimental policy enforcement logic

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