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Coverage of metrics by OSI levels

graph LR
 L1["L1 Physical
NIC counters via system"]
 L2["L2 Data Link
MAC, VLAN"]
 L3["L3 Network
IP, IPSec ESP, GTP-U"]
 L4["L4 Transport
TCP/UDP/SCTP"]
 L5["L5 Session
GTPv2-C, IKEv2"]
 L6["L6 Presentation
IKEv2/IPSec encryption, EAP-AKA"]
 L7["L7 Application
Diameter, service bearer ops"]
 Operations["Operations
KPI, SLA, Capacity"]
 CX["CX Level
Subscriber Experience"]
 L1 --> L2
 L2 --> L3
 L3 --> L4
 L4 --> L5
 L5 --> L6
 L6 --> L7
 L7 --> Operations
 Operations --> CX
 style L1 fill:#e74c3c,color:#fff
 style L2 fill:#e67e22,color:#fff
 style L3 fill:#f39c12,color:#fff
 style L4 fill:#2ecc71,color:#fff
 style L5 fill:#1abc9c,color:#fff
 style L6 fill:#3498db,color:#fff
 style L7 fill:#9b59b6,color:#fff
 style Operations fill:#34495e,color:#fff
 style CX fill:#2c3e50,color:#fff

Detailing metrics by level

OSI model:

Level	Metrics	Examples
L1/L2 Physical / Data Link	-	Covered by a separate node_exporter or equivalent at the OS level (not included in the ePDG metrics list)
L3 Network / IPSec tunnels	3	epdg_gtpu_packets_total, epdg_gtpu_bytes_total, epdg_gtpu_errors_total — GTP-U data plane
L4 Transport	1	epdg_network_connection_status — TCP connections to nodes (PGW/AAA/HSS)
L5 Session	3	epdg_session_ike_sa_total, epdg_session_child_sa_total, epdg_session_gtp_sessions_total
L6 Presentation/Security	3	epdg_ikev2_messages_total, epdg_ikev2_request_duration_seconds, epdg_ikev2_errors_total — IKEv2/IPSec encryption and EAP-AKA authentication
L7 Application	9	epdg_diameter_* (SWm/SWx/S6b, 5 metrics), epdg_gtp_* (GTPv2-C, 4 metrics)

Operator level:

Level	Metrics	Examples
Operations	11	epdg_service_availability, epdg_service_uptime_seconds, epdg_app_* (3), epdg_system_* (4), epdg_config_* (2)
Customer Experience	3	epdg_service_attach_duration_seconds p95, epdg_service_attach_total (success rate), epdg_ikev2_request_duration_seconds p99

Level 9: Quality of VoWiFi service perception

QoE indicator	Source metrics	Interpretation
VoWiFi connection time	epdg_service_attach_duration_seconds p95	> 3 seconds — subscriber notices delay when switching to WiFi
Continuity of service	epdg_session_ike_sa_total delta	Mass discharge > 50 IKE SA = accessibility issue
Authentication success	ePDG_High_Attach_Failure_Rate alert rate	> 5% = HSS/AAA node problem
Delayed appointment bearer	epdg_gtp_request_duration_seconds{msg=create-session} p99	> 500 ms — delayed availability of voice channel
GTP-U tunnel	epdg_gtpu_errors_total rate / epdg_gtpu_packets_total	> 0.1% = degradation of voice quality
IKEv2-reliability	epdg_ikev2_errors_total by type	NO_PROPOSAL_CHOSEN / AUTHENTICATION_FAILED — problems with certs / UE