

# Acme Packet Net-Net Diameter Director

## Overview

The Net-Net® Diameter Director is a Diameter signaling controller (DSC) from Acme Packet that addresses critical security, interoperability, routing and scaling challenges in next-generation Long Term Evolution (LTE) and IP Multimedia Subsystem (IMS) networks. It supports multiple applications—core Diameter routing, LTE data and VoLTE roaming, and federated service delivery—by enabling the exchange of subscriber profile information within-or-between LTE networks.

LTE and IMS networks use Diameter signaling to exchange subscriber profile information between network elements for subscriber authentication and for each data or IMS session. More specifically, subscriber and session authentication, authorization, mobility, charging and quality of service (QoS) information is exchanged among many elements in the network, including HSS, PCRF, OCS, MME and CSCF. This information is also exchanged between visited and home networks for roaming subscribers.

The Net-Net Diameter Director is a Diameter agent that provides a critical intermediary control function for Diameter transactions and sessions. These control functions—congestion control, mediation and routing—for Diameter signaling enable the seamless communication of subscriber data and reduce the mesh of Diameter connections that negatively impact network performance, capacity and management.

The Net-Net Diameter Director is supported on Acme Packet hardware and select third-party server platforms. It leverages the Acme Packet Net-Net OS software platform to offer industry-leading DSC security and control capabilities for Diameter signaling, performance, carrier-class availability and manageability. These functions reduce costs, streamline networks and assure availability for LTE and IMS networks.

## Acme Packet Edge

- Scalable signaling architecture
- Comprehensive Net-SAFE security
- Rapid & dynamic interoperability
- Flexible routing policies

## Applications

- Core Diameter routing
- LTE data & VoLTE roaming
- Federated service delivery

## Key Features

- High-performance, stateful Diameter processing
- Security & congestion management
- Interworking & mediation
- Routing & load balancing
- High availability
- Centralized monitoring, signaling recording & KPI reporting
- Broad Diameter application & standards support

## Benefits

- Cost-effective network scalability
- Simplified provisioning
- Secure roaming borders
- Ease of interoperability
- Rapid time to market
- Improved visibility

Net-Net Diameter Director

Applications

The Net-Net Diameter Director is a Diameter agent supporting relay and proxy modes, and provides an intermediary control function for all Diameter transactions and sessions. It also meets key 3GPP and GSMA functional requirements in IMS/LTE networks, including:

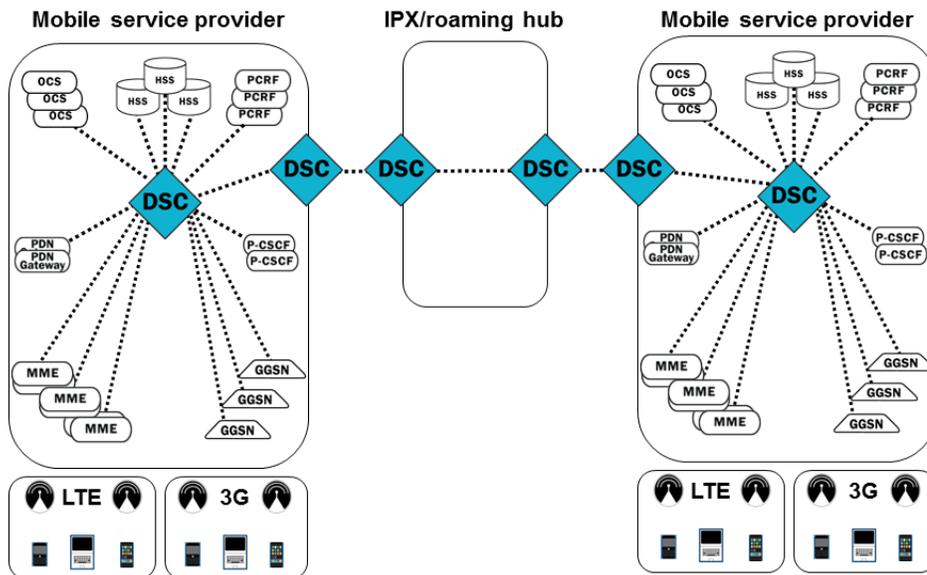
- **Diameter Routing Agent (DRA):** Provides enhanced routing with subscriber and session binding in a multiple PCRF server environment.
- **Subscriber Location Function (SLF):** Selects the appropriate HSS for a given subscriber based on profile information.
- **Diameter Edge Agent (DEA):** Provides security, interworking and routing functions to manage Diameter signaling between visited, home and roaming hub/IPX providers.

Acme Packet's Diameter signaling controller goes beyond these functional definitions to provide a comprehensive set of proxy, routing, security and control functions for all authentication, charging, mobility and QoS policy exchanges in 3G, LTE and IMS networks. The Net-Net Diameter Director supports multiple core and edge applications:

- **Core Diameter routing:** Aggregation, mediation and management of all authentication, mobility, charging and QoS policy interfaces in a 3G, LTE or IMS core network. In addition to a general aggregation and routing role, the Net-Net Diameter Director can provide specific proxy functions for HSS, PCRF and OCS servers.

• **LTE data and VoLTE roaming:** Control of authentication, QoS and charging information exchanged between visited, home and wholesale IPX/roaming hub service providers to support access to voice and data services for roaming subscribers.

• **Federated service delivery:** Secure border point between broadband providers and MVNO or Web/cloud-based services for subscriber authentication, QoS and charging, enabling new revenue-sharing business models while ensuring an optimal user experience.



Net-Net Diameter Director core & roaming applications

## Net-Net Diameter Director

## Performance and Capacity

The Net-Net Diameter Director is supported on Acme Packet hardware as well as carrier-grade commercial server platforms, meeting a wide range of capacity, performance and functional requirements. Regardless of platform, the core Acme Packet software, Net-Net OS, provides the same control functions for Diameter signaling and fulfills Diameter processing performance requirements with compelling price-performance measurements.

The platform portfolio provides flexibility to match the performance and price points for individual environments. Scalability extends beyond performance to also include thousands of internally and externally connected Diameter elements.

The Acme Packet Net-Net 4500 platform provides customers with performance matched with hardware-intensive processing requirements, such as DoS protection and encryption.

Hardware-accelerated IPsec tunnels are available on the Net-Net 4500 platform so that Diameter messages can be securely routed without impacting system performance.

The Net-Net Diameter Director 7000 series on third-party servers provides highly scalable performance by leveraging the latest multi-core processor platform advancements. Acme Packet hardware platforms are well-suited for edge DSC applications and third-party servers for core DSC solutions.

## Features and Functions

The rich functionality of Net-Net OS underlies the Net-Net Diameter Director, providing features that deliver key benefits to service providers building 3G, LTE and IMS networks:

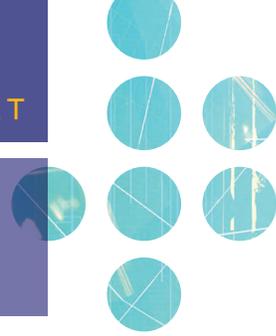
- Streamlined & scalable network
- Lower total cost of ownership
- Improved network resiliency
- Faster time to market
- Enhanced visibility & manageability
- Secure LTE roaming border
- Best of breed vendor selection

The Net-Net Diameter Director can be configured to act as a relay or a proxy. In both modes, the Net-Net Diameter Director performs proxying functions, including topology hiding, unilateral responses based upon network conditions, traffic controls and signaling normalization.

As a proxy, the Net-Net Diameter Director adds application awareness of specific Diameter interfaces as well as KPI measurements for specific Diameter applications. These features deliver superior

functionality for routing, security, traffic control, interoperability and monitoring and analysis. The Net-Net Diameter Director also provides carrier-class active-active or active-standby high availability across all Acme Packet hardware and third-party server platforms.

Net-Net Diameter Director



**Centralized and Intelligent Routing**

The flexible and scalable routing engine from Acme Packet enables networks to grow efficiently and allows service providers to enforce complex business logic. The Net-Net Diameter Director’s high-performance Diameter routing

engine is capable of routing Diameter messages based on any message content.

As the hub for all Diameter signaling, the Net-Net Diameter Director simplifies provisioning

of new elements as the network grows—provisioning and updating routing tables is streamlined in a centralized Diameter agent, eliminating the N-squared connected mesh of interconnected Diameter elements.

Routing Features	Applications/Use Cases	Benefits
Route by any Diameter message content (Source/Destination Realm, Application-ID, VPLMN-ID, IMSI & others) & Command-Code	All AAA, QoS, mobility & charging applications Subscriber-based routing (IMSI-HSS matching & home network resolution) Roaming steering (preferred network selection)	Architectural flexibility Supports current & future interfaces/applications
Nested-policy routing architecture	Complex routing environments	Easy to provision & troubleshoot High performance
Local route table & external database support	IMSI-to-resource mapping	Scalability Dynamic route recursion
Subscriber & session awareness	Binds subscribers to a single PCRF or OCS resource	Consistent subscriber QoS application Accurate accounting
Failure detection & alternate routing	Routes around network & element failures	Improved network availability Service continuity
Customizable rules	Customer-defined applications	Application & routing flexibility

Net-Net Diameter Director



**Interworking and Mediation**

The Net-Net Diameter Director provides a comprehensive set of layer 3–5 interworking capabilities to provide rapid interoperability between vendors, elements and service provider networks.

The normalization and mediation functionality accelerates time to market as vendors and roaming partners are added and changed over time. This interworking

capability enables service providers to choose best-of-breed Diameter elements as opposed to being restricted to a single vendor.

The information in Diameter messages, Attribute-Value Pairs (AVPs), can be modified, added or removed based on specified criteria as messages traverse the Net-Net Diameter Director. The Acme Packet Diameter manipulation functionality

provides a powerful interoperability tool that is not dependent on feature enhancements or software updates. Using session programming language, customer-specific functionality can be added to address unique customer applications in the areas of billing, complex IMSI remapping or other non-standard behaviors.

Features	Applications/Use Cases	Benefits
Normalization of capabilities exchange	Enables a Diameter connection to be established between any two Diameter elements	Rapid time to market Multi-vendor interoperability Architectural flexibility
Diameter manipulations	Normalizes Diameter signaling Adds, modifies or removes AVPs or copies information into other AVPs Response code manipulation	Rapid time to market Multi-vendor interoperability Best-of-breed architecture Architectural flexibility Improves routing
Transport layer normalization	Offloads transport layer aggregation from Diameter servers Normalizes transport layer in the network core	Simplifies configuration Lowers total cost of ownership Improves Diameter server performance
IPv4/v6 interworking	Supports mix of different internal & external network addressing	Increases roaming partner universe Minimizes disruption during migration Rapid time to market Architectural flexibility
Customizable rules	Customer-defined manipulations	Application flexibility Rapid interoperability

**Traffic Controls**

The Net-Net Diameter Director includes traffic control functionality that maximizes the utilization of existing network resources and provides robust overload controls

to assure network availability. In addition, attached Diameter elements are monitored for availability and the Net-Net Diameter Director can use

alternatives routes in the event any Diameter elements are out of service.

Features	Applications/Use Cases	Benefits
Dynamic signaling rate policing	Prevents overload of DSC Prevents overload of Diameter elements & back-end databases Prevents overload of HSS back-end servers	Improves network & service availability
Failure detection & alternate routing	Routes around out-of-service elements	Improves network & service availability
Diameter load balancing	Balances traffic across multiple servers	Optimal utilization of Diameter server resources

Net-Net Diameter Director

**Comprehensive Security**

Acme Packet's Net-SAFE™ security framework is applied to Diameter signaling, providing the complete feature set to secure the LTE roaming border and protect

revenue-producing elements in the network, such as HSS and OCS servers. Acting as the single demarcation point for LTE roaming, the Net-Net Diameter Director

protects networks from attacks and non-malicious overloads to assure network availability and roaming revenues.

Features	Applications/Use Cases	Benefits
Dynamic signaling rate limiting	Signaling overload protection Denial of service attack protection	Improves service availability
Topology hiding	Prevents external parties from directing attacks & identifying routes	Improves service availability
Access control & packet filtering	AVP whitelists/blacklists	Restricts elements that can communicate with Net-Net Diameter Director
Resource starvation protection	Enhances Net-Net Diameter Director performance & availability	Improves service availability
Diameter fuzzing protection	Protects against attacks with malformed Diameter messages	Improves service availability
IMSI range blocking	Enforces business logic for roaming based upon the IMSI range owned by specific service providers	Enforces preferred roaming agreements Reduces costs for roaming settlement
Hardware accelerated Diameter encryption	Mutual certificate-based authentication Confidential exchange of Diameter messages	Improves identification of roaming partners Safeguards against Diameter message tampering & eavesdropping Protects against service theft

**Monitoring and Analysis**

The Net-Net Diameter Director aggregates all Diameter interfaces and processing from other elements, which allows the network to scale effectively. This aggregation also provides recording and data indexing capabilities for long-term storage and analysis of Diameter

traffic across a large multi-element network.

Diameter messages may be selectively replicated based upon interface or multiple parameters, including Diameter interface and Diameter agent. With network call

tracing and troubleshooting tools, network operators can fully track, debug issues and quickly perform root cause analysis. These tools improve visibility of the network and enhance network planning and design as well as settlement with roaming partners.

Features	Applications/Use Cases	Benefits
Key performance indicators	Identify anomalous network behavior Uncover network fault conditions & performance issues	Improves service availability
Diameter transaction storage	Networking debugging Forensic roaming analysis & billing correlation	Identify & isolate misconfigurations & problems with existing network provisioning Reconcile roaming billing
Analysis of Diameter messages & characteristics based on content, time & location	Identify network traffic patterns & trends	Improved network planning Enhances network optimization & capex planning
Tracing	Debug specific Diameter sessions	Faster troubleshooting

## Net-Net Diameter Director

**Broad Interface Support**

The Net-Net Diameter Director provides universal Diameter interface support. The major interfaces include:

Application	Diameter Client	Diameter Server	Interface/Profile
3G/LTE/IMS subscriber authentication & mobility	MME SGSN AS CSCF AS/CSCF	HSS HSS HSS HSS SLF	S6a S6d Sh Cx Dh, Dx
FMC subscriber authentication	PDG & ePDG Security Gateway PDN-Gateway	AAA AAA AAA	Wm/SWm Wm S6b
Online & offline charging	Application server CSCF & SBC GGSN & PDN-Gateway	OCS OCS OCS/OFC	Ro Rf Gy, Gz
QoS & bandwidth reservation	CSCF & SBC GGSN & PDN-Gateway	PCRF PCRF	Rx Gx
LTE roaming	MME (visited) SGSN (visited) PCRF (visited)	HSS (home) HSS (home) PCRF (home)	S6a S6d S9

**Carrier-Class High Availability**

Across all hardware platforms, the Net-Net Diameter Director supports a high availability configuration with active and standby units or with active and active units. In both configurations, Diameter message transaction, session, subscriber and peer state is checkpointed between both Net-Net Diameter Director units to ensure service availability in the event of a unit or site failure.

**SCTP Multi-Homing**

The Net-Net Diameter Director further enhances network resiliency with SCTP local and remote multi-homing, which provides path redundancy at the transport layer so Diameter traffic can reach a destination in the event of a single path failure.

**Management**

Net-Net Central<sup>®</sup>, the fully integrated, extensible management system from Acme Packet, provides provisioning of the Net-Net Diameter Director and an analysis of key performance indicators and Diameter signaling data. The Net-Net Diameter Director can also be managed by CLI and telnet. Secure File Transfer Protocol can be used to update local route tables with XML. RADIUS is used for accounting and SNMP and syslog for monitoring.



## Technical Specifications

### RFC 3588 Diameter Agent Support:

Relay  
Proxy

### 3GPP Diameter Agent Support:

Diameter Routing Agent (DRA)  
Subscriber Location Function (SLF)

### GSMA Diameter Agent Compliance:

Diameter Edge Agent (DEA)

### Diameter Interfaces:

Diameter Credit Control

A3	Gx	Rw	SWd
A4	Gxa	Rx	SWm
Bi	Gxb	Rx+	SWn
Cx	Gxc	S6a	SWx
Dh	Gy	S6b	Tx
Dw	Gz	S6d	Ty
Dx	H2	S7c	Wa
Dz	Mz	S9	Wd
E2	Pr	S13	Wg
E4	Re	SGi	Wm
E5	Rf	Sh	Wx
Gi	Ro	Sp	Zh
Gmb	Rr	Sta	Zn
Gq	Rs	SWa	Zn'
Gq'			

### Management:

Net-Net Central  
Element Manager  
CLI  
SSH  
telnet  
SFTP  
XML  
RADIUS  
SNMP  
syslog

### IP Protocols:

IPv4  
IPv6  
IPv4-v6 interworking

### Supported Platforms:

Net-Net 4500  
Net-Net 7000 series

### Transport Protocols:

TCP  
SCTP  
TCP-SCTP interworking

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