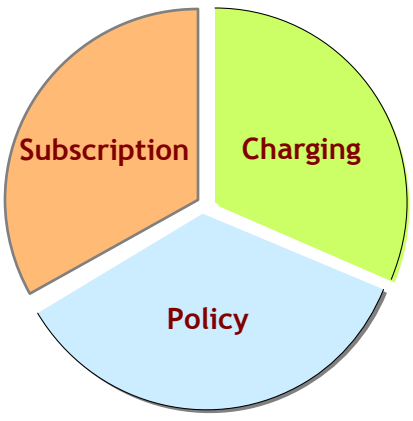
Accelero™ Diameter

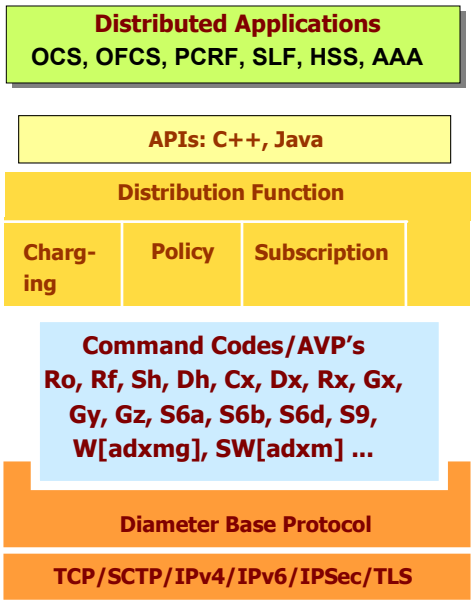
Enabling Policy, Charging and Subscription in EPC, IMS, MMD Networks

The promise of converged networks with an all-IP interconnectivity comes closer with the IP Multimedia Subsystem (IMS) in the UMTS/WCDMA/HSPA 3G network, the Multimedia Domain (MMD) of the CDMA2000/EV-DO 3G network and more recently with the Evolved Packet Core (EPC) of the LTE 4G network. While RADIUS was the original the protocol of choice, the Diameter protocol has been adopted as the standard for all aspects of policy, charging and subscription management.

Diameter is based on RADIUS but has been enhanced to support failover, transmission security, reliable transport, agent support, server initiated messages, capability negotiation, peer discovery and configuration and is expandable with command codes (CC) and attribute-value pairs (AVP). The base Diameter protocols have been defined in the IETF and these have been extended using additional CCs and AVPs by the 3GPP and 3GPP2 to support interfaces between the IMS, MMD and EPC network elements.

Charging/Policy functions include the On-line Charging System (OCS), Off-line Charging System (OFCS), Policy and Charging Rules Function (PCRF) that use Ro, Rf, Rx, Gx, Gy, Gz S6a, S6b, s6d and S9 interfaces. Subscription management functions include the Home Subscriber Server (HSS), Subscriber Location Function (SLF) that use Sh, Dh, Cx, Dx, and AAA that uses Wa, Wd, Wx, Wm, Wg, SWa, Swd, SWx, SWm interfaces.





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Diametriq offers a very high performance, scalable, reliable carrier-grade implementation of Diameter that can be used to build 3G and 4G core network elements. The Accelero Diameter has been used by tier one mobile equipment vendors and deployed in tier one operator networks.

Accelero Diameter includes support for the most popular Diameter interfaces used by EPC, IMS and MMD. Also included is an ABNF compiler and extensible XML-based data dictionary that allows changes to existing and new Diameter interfaces in just a few days.

Accelero Diameter also includes the Diameter Relay, Proxy and Redirect agents and a Diameter Routing Agent. It can be supplied in a number of flexible licensing models, including source code, royalty-based and unlimited distribution binary.

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Object-Oriented API

The Diameter protocol and applications are specified with a set of commands (or messages). Each command contains a set of Attribute Value Pairs (AVP). The Accelero Diameter implementation provides a user-friendly API that provides classes for each command, AVPs and the complex types. Simple Set, Get and Print methods are provided to enable access to the AVPs.

This interface provides a type-safe programming approach. Cumbersome searching within a command to retrieve the elements and the onerous task of encoding tags, etc. is completely abstracted from the developer. This results in clean, easy-to-use code.

The API also provides a flexible mechanism to support known vendor-specific extensions in this uniform format. Any unknown extensions received during runtime can be passed to the application for inspection and action. The API presents a uniform signature for all interfaces. For example, an application can use Sh and Rf interfaces seamlessly.

Linkable Library Mode

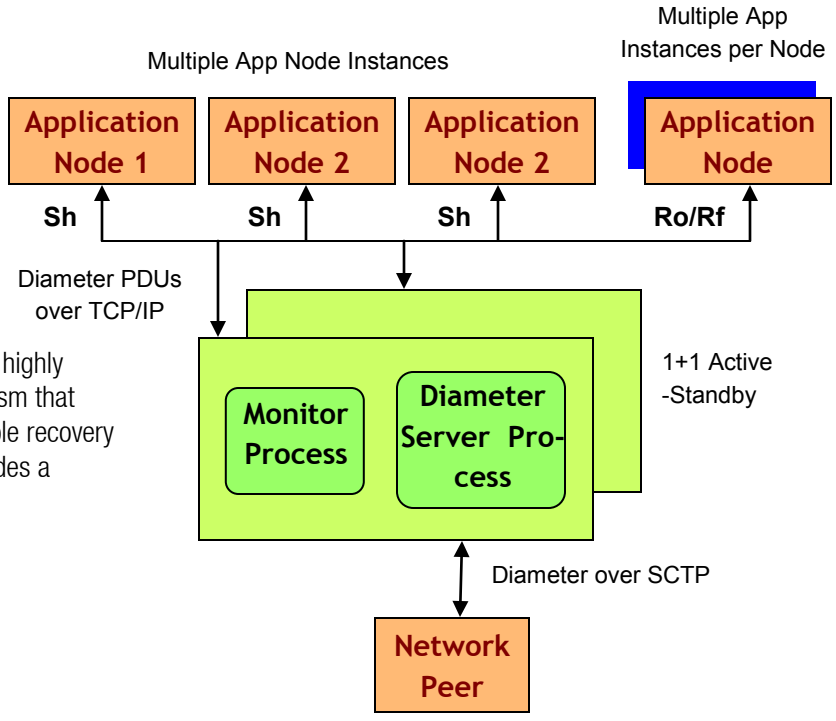
For compact architectures based on a single process the linkable library mode provides a seamless approach whereby the process can harness the features of the Diameter implementation in a multi-threaded model. Accelero Diameter runs in its own thread of execution, providing support for all features of capabilities exchange, watchdog, peer and session control.

Accelero Diameter also provides a multi-threaded dispatch and receive mechanism for communicating with the application worker threads. The Accelero platform extends a complete process infrastructure environment that can accelerate new application development. Library mode also supports Active/Hot Standby redundant operation.

Distributed Server Mode

The Distributed Server Mode Package is designed to provide a single point of Diameter access to a set of distributed clients. The clients may be implemented as multiple processes, multiple nodes or a combination of both. The application clients communicate with the Diameter front-end server via an IP socket-based interface.

The Accelero Diameter front-end server provides a highly available 1+1 active-standby redundancy mechanism that synchronizes session and state information to enable recovery in the event of a failure. The front-end server provides a health monitor process to enable switchovers.



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Technical Features	
Product Type	Software, Linkable Library Mode or Distributed Server Mode Configurations
Library Mode	Static or Dynamically Linked
Distributed Mode	Separate Process
Multi-threading Support	Thread Safe: supports both multi-threaded and single-threaded environments
CPU Support	Single processor/Multi processor/32 bit/64 bit
Platforms Supported	Linux (RedHat ES 4/5, WindRiver PNE)
	Solaris-9/10
	Others available – contact Diametriq
Logging and Tracing	Dynamic levels of debug
	File-based logs/traces
Development Environment	C++, Java
	API-programmer interface
	Demo Applications
IETF Interfaces	
Diameter Base	RFC 3588
Diameter Mobile IPv4 Application	RFC 4004
Diameter Network Access Server App	RFC4005
Diameter Credit-Control Application	RFC 4006
Diameter EAP Application	RFC 4072
Diameter SIP Application	RFC 4740
Diameter Mobile IPv6	RFC 5447
3GPP Interfaces	
Ro/Rf: AS to OCS/OFCS	32.225 Release 5
Sh/Dh: AS to HSS/SLF	29.328/329 Release10
Cx/Dx: CSCF to HSS/SLF	29.228/229 Release10
Rx: AS to PCRF	29.214 Release 10
Gx: PCEF to PCRF	29.212 Release 10
Gy: PCEF to OCS	32.251 Release 10
Gz: PCEF to OFCS	32.295 Release 9
Dw/Wa/Wd/Wx/Wm/Wg/Pr: I-WLAN	29.234 Release 9
S6a/d: MME/SGSN to HSS	29.272 Release 10
S6b/SWa/SWd/SWx/SWm/H2: EPS AAA	29.273 Release 10
S9: V-PCRF to H-PCRF	29.215 Release 10
3GPP2 Interfaces	
Ro/Rf: AS to OCS/OCFS	X.S0013-007/8-A Version 1
Sh/Dh: AS to HSS/SLF	X.S0013-010/11-B Version 1
Cx/Dx: CSCF to HSS/SLF	X.S0013-005/6-B Version 1
Tx: CSCF to PCRF	X.S0013-013-0 Version 1
Ty: AG to PCRF	X.S0013-014-0 Version 1
Transport and Security	
Transport: SCTP (or TCP)	RFC 2960/4960 (Note: SCTP supplied in Linux kernel 2.6 /Solaris 10 and later.)
Security: IPSec and TLS	RFC 4301 and RFC 4346 (Note: Uses OpenSSL and GnuTLS)
IP V4/V6	Uses Linux/Solaris IP

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Accelero™ Diameter Deployments

- **Motorola** is using Accelero™ Diameter for the LTE Packet Core Network MME application based on Rel8 3GPP standards.
- **Bridgewater Systems** uses Accelero™ Diameter in its AAA Service Controller for multiple access networks, including WiMAX and CDMA.
- **XIUS-bcgi** uses Accelero™ Diameter in its RFC 4006 compliant Credit Control application.
- **Ventraq** uses Accelero™ Diameter in its FMC and IP-Multimedia Subsystem (IMS) solutions including WLAN and WiMAX applications.

Core Expertise. Fast Delivery. Controlled Costs. Exceptional Results

At Diametriq, we partner with our customers to develop custom product solutions that help them deliver new revenue -generating products and services, improve operational efficiencies, and reduce costs. Our customers include the world's leading network equipment suppliers, software developers, and hosted service providers. We work closely with them to understand their requirements and anticipate how our products and services can best meet their needs.

We combine wide-ranging software experience, peerless understanding of industry dynamics, and meticulously detailed software processes to deliver market-leading solutions. We can augment a customer's in-house development team with specialized expertise, or we can assume complete responsibility for a project from requirements definition to system verification - freeing up our customer to focus on other priorities. We are particularly experienced in the areas of location-based services (LBS), roaming and mobility, convergent billing, 3G/4G fixed mobile convergence (FMC), advanced messaging, and the IP Multimedia Subsystem (IMS).

Diametriq uses its **Accelero™** platform to build custom solutions. Accelero embodies the knowledge and experience of our engineering team and enables us to accelerate time to market, reduce cost, and minimize the risk associated with delivering new solutions.

We adhere to rigorous quality standards for every project. Our ISO 9000:2000 certification reflects an organization committed to producing high quality, carrier-grade communications solutions - even those requiring "five nines" reliability.

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