High Performance Service Layer Processing Engine

White Paper

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1 Introduction

Increasingly heavy network traffic has caused service availability, reliability and performance problems for operators for several years. The vendors of monitoring solutions have used different approaches in the attempt to cope with the challenges presented by the need to monitor and analyze this increased traffic.

The purpose of this paper is to introduce RADCOM's high performance service layer monitoring engine, the hardware-centered GearSet™.

1.1 Next-Generation Network Challenges

To support the latest revenue-generating multimedia services, service providers are currently investing heavily in their networks. Customers' expectations for continued high quality of service demand that operators meet new monitoring challenges. However, the issue of monitoring is now more complex due to:

- Higher traffic loads as more and more subscribers join the new services
- Convergence of IP, PSTN and mobile networks
- Use of multiple interfaces
- Combining of services such as Voice, Data, Video and IPTV

Regardless of technology or type of service, operators need to be able to monitor their services effectively and troubleshoot problems quickly.

1.2 The Requirements

In order to meet current and future monitoring demands of operators around the world, there is a critical need for a flexible and versatile, high-performance online engine. Such an engine must be able to simultaneously analyze a variety of applications and services implemented on a variety of technologies that use a variety of protocol stacks, all at very high traffic rates.

The features that were required from RADCOM's system engineers include:

- High online performance
- Flexibility to support new services, features and capabilities
- Scalability to handle higher traffic loads, more subscribers, transactions and services
- Update and upgrade ease
- High level of responsiveness to customer requests
- Reasonable time to market and time in market
- Balanced solution that avoids bottlenecks
- Cost-effectiveness

RADCOM has created this engine with its proprietary three-chip hardware engine solution, the GearSet. It is the main processing resource in RADCOM's new high-performance probe and the leading edge of RADCOM's service monitoring solution for service providers' operational networks.

2 The Nature of Monitored Traffic

Monitored traffic can be divided into two categories:

1. The Control/Signaling plane, which includes transaction-related signaling, network element control messages, management traffic, etc.
2. The User/Data plane, which includes the content of the user data such as Voice, Video, SMS, HTTP, FTP, etc.

The Control/Signaling plane is characterized by a variety of services, protocols, hierarchical models, multi-vendor environments and relatively low rates. Because it is necessary to analyze every signaling message in order to perform call tracing, a software-based approach offers the best method to deal with this complex, heterogeneous and constantly evolving plane.

The User/Data plane is characterized by high traffic rates, repetitive content types and a variety of CODECs per service. Typically, there is no need to implement deep-packet-analysis. However, there may at times be a need to gauge end-user experience with packet-by-packet analysis and voice/video playback. The best way to deal with these repetitive processing needs, on one hand, and the high traffic rates on the other, is with network processor or hardware-centered methods.

3 Alternative Approaches to the Challenge

RADCOM's design team has determined three possible methods of approaching the traffic monitoring challenge:

1. Software-centered
2. Network processor-centered
3. Hardware-centered

3.1 Software-Centered Approach

This approach employs either single-level parallel processing or multiple-level sequential processing, or a combination of both.

With parallel processing, in order to optimize processing performance, incoming data is forwarded to multiple processors according to specified rules that implement load balancing methodologies.

With dual-level processing, there are front-end processors, typically RISC processors, which deal with the high-rate, relatively simple, routine tasks. There are also back-end processors that deal with the signaling tasks, as well as device and board management tasks, network connectivity and background tasks.

Pros	Cons
• most flexible, thus highly responsive to special customer requests • offers a variety of operating systems • offers off-the-shelf 3rd party tools and specific modules • good time to market	• relatively low performance • not easily scalable • hard to estimate actual performance prior to testing

3.2 Network Processor-Centered Approach

A network processor is a device optimized by its internal architecture, hardware processing modules, CPUs (if there are any), software commands and operating system (if there is one) to execute a defined set of network processing tasks.

There are a few network processor families and a variety of architectures to implement them, depending on the specific tasks expected from these families (QoS, layer 2-4 processors, etc.).

In some cases, depending on the nature of the network processor and the characteristics of the device being developed, more than one network processor may be used.

Pros	Cons
• relatively high-performance • relatively flexible, thus only relatively responsive to special customer requests	• not easily scalable • no easy way to add new types of features/capabilities • device-specific knowledge, tools and environment

3.3 Hardware-Centered Approach

A programmable hardware-based concept assumes that the tasks can be divided up, so that some are handled by hardware, with SW assistance if required, and others are handled by software.

As already mentioned, network traffic can be largely divided into Control/Signaling plane and User/Data plane. While User/Data plane tasks are relatively finite, routine, simple and of high-rates, and therefore appropriately handled by programmable hardware, the Control/Signaling plane tasks are more complex, protocol stack-related, state machine-based and must deal with a multi-vendor environment, and are therefore more appropriately handled by SW.

Pros	Cons
• high-performance for both User/Data planes based on HW processing and Control/Signaling plane based on SW processing • flexible where needed, i.e. Control/Signaling plane • allows integration of off-the-shelf 3rd party modules both in HW and SW	• relatively expensive • longer time to market • longer designs per new content and content analysis

3.4 Summary of Alternative Approaches

Based on the needs of service providers' operational networks and their most important performance and monitoring demands, RADCOM's design team recommended adopting the hardware-centered approach, because it offers:

- The highest performance;
- The most balanced architecture; and
- Once infrastructure is set, adding technologies, services, protocols, etc. is relatively simple and fast.

4 The GearSet: An Unbeatable Processing Engine

RADCOM's GearSet is the company's proprietary three-chip hardware engine solution implemented in the new high performance R70 probe for User/Data plane online analysis.

The GearSet is a three-chip session processor designed to provide unmatched wirespeed monitoring performance, independent of technologies or services, on all layers. It allows one platform to monitor UMTS, CDMA, IMS, SDP, VoIP, IPTV and more technologies to come.

It also allows one platform to monitor quadruple-play services at unprecedented processing rates, giving service providers the advantage they need to compete in a constantly changing environment.

The GearSet revolutionizes online processing by offering session-level parsing, classifying, filtering, capturing and deep-packet analysis at line rates from E1/T1 up to 10 Gbps.

The GearSet is instrumental in positioning RADCOM as the industry leader in the high-performance communication monitoring solutions market. It also makes it possible for RADCOM to rapidly develop and roll out new applications by means of its flexible and scalable architecture and nearly unlimited customization capabilities.

The GearSet is an expansion of the revolutionary GEAR chip, offering higher performance, yet remaining compatible with former solutions.

4.1 GearSet Features and Specifications

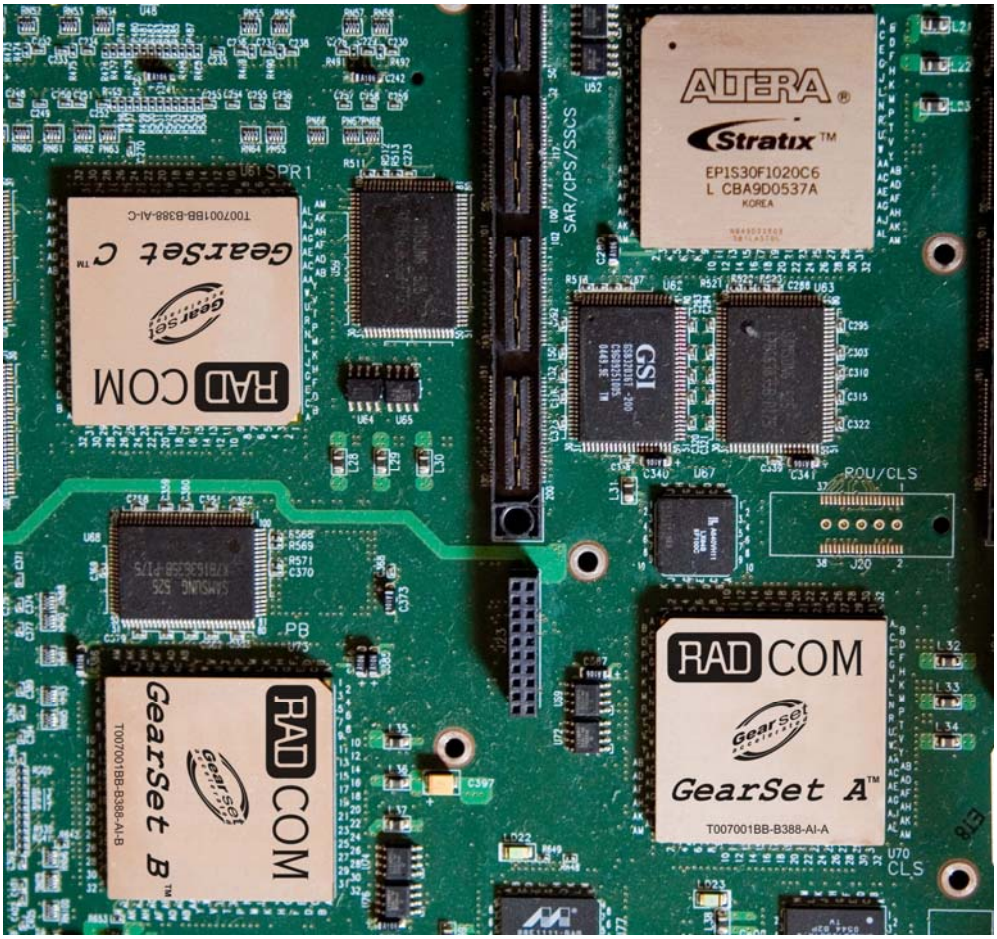
4.1.1 Features

- Line rates from E1/T1 up to full duplex 10GbE
- Large number of line-rate programmable & flexible filters & triggers
- Session builder working in conjunction with the dedicated Control plane processor
- Programmable classifier to support multiple simultaneous protocol stacks
- Line-rate support of multiple simultaneous services
- Session- based, User/Data and/or Control/Signaling plane capture
- Packet-by-packet capture
- Technology- and service-independent
- Nearly unlimited customization with high-speed programmable hardware modules
- Online path for high-performance CPU/DMA connection

4.1.2 Technical Specifications

- Number of chips: 3
- Chip process: 90 nm
- Data processing level: Sessions at the application layer
- Internal bus widths: 64/128 bit

4.2 Illustration



Implementation of the GearSet: Detail from the main board of RADCOM's new, high performance R70 probe

4.3 Functional Description

4.3.1 Classifier

The Classifier module acts as a packet co-processor and performs full parsing and inspection of incoming packets according to the user's application. The result of the parsing and inspection process is a packet header attached to each packet.

The packet inspection is performed by code (like a high-definition assembler). Both parsing and inspection are compiled and then downloaded to the target module within the GearSet chipset. This per-packet additional information is then used for both session-building and per-packet filtering, wherever packet level filters are required.

The module consists of eight independent and parallel-running engines that support high bandwidth. Each module acts as a processor, with a full set of registers, data/code memory and instructions.

4.3.2 Session Processor

From the Classifier, the Session Processor receives packets sorted by session/stream, according to user definitions. The Session Processor analyzes these streams and produces a session summary known as xDR or CDR (Call Detail Record). The session summary contains various statistics and general quality scores (such as VoIP MOS) for each session.

4.3.3 Capture

The Capture module allows recording of the monitored lines of several different planes, either packet-by-packet (with or without packet filters) or per session (with or without session filters). User Plane capture, for example, can easily be performed with the GearSet capture capabilities.

Capture can be stored to an ultra-high rate on-board capture buffer, the host server's disk or a network-attached storage device. This flexibility allows both ultra-high rates and almost unlimited storage volumes for long traces, where required.

5 Summary

With the evolution of next-generation networks, operators face challenges of higher traffic loads and increasing technological complexity, issues which demand a balanced approach to network monitoring. The GearSet is designed to provide premium performance, independent of technologies or services, on all layers. RADCOM's monitoring solution is therefore in position to help guarantee quality for quadruple-play services at unprecedented processing rates, giving service providers the advantage they need to compete in a constantly changing environment.

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