# The Effnet ROHC Product Portfolio for LTE

The Effnet ROHC product portfolio consists of software products based on various RFCs which define RObust Header Compression (ROHC). ROHC is a header compression algorithm and protocol standardized by IETF. The Effnet ROHC product portfolio will provide significant improvements in link efficiency for TCP traffic e.g. web, file transfers etc., RTP and UDP traffic e.g. real time, interactive and streaming applications and ESP traffic e.g. secure traffic over high BER, long RTT links.

ROHC is recommended by 3GPP for efficient use of radio resources since Release 4 onwards and even by 3GPP2 and WiMAX for similar reasons. It is an important component of the IP Multimedia Subsystem (IMS). ROHC is also used to improve efficiency in many other data networks such as satellite, WAN and ad-hoc (military applications) etc.
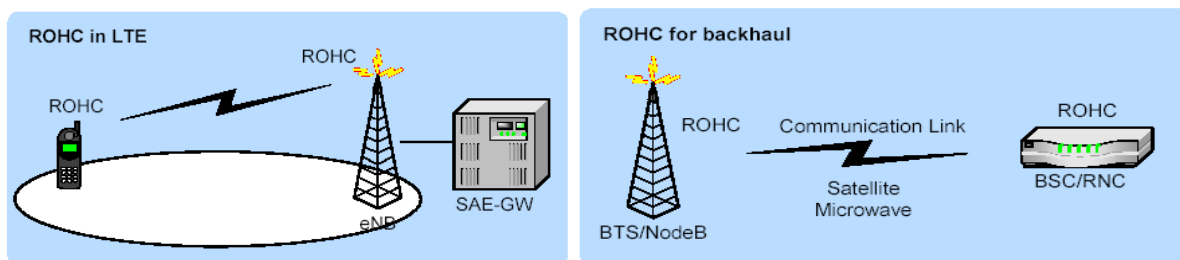
3GPP's Long Term Evolution (LTE) project focuses on enhancing the Universal Terrestrial Radio Access (UTRA) and optimizing radio access architecture. LTE has adopted packet-switch technology using end-to-end IP communication instead of traditional circuit-switching. One of the LTE specifications, Packet Data Convergence Protocol (TS 36.323) specifies use of ROHC. It supports the following ROHC framework and profiles implemented in the form of various Effnet products:

Product	Usage	Profile Identifiers	References
Effnet ROHC™	Uncompressed, RTP/UDP/IP, UDP/IP, ESP/IP	0x0000, 0x0001, 0x0002, 0x0003	RFC 3095, RFC 4815
Effnet ROHC-IP™	IP	0x0004	RFC 3843, RFC 4815
Effnet ROHC-TCP™	TCP/IP	0x0006	RFC 4996
Effnet ROHCv2™	RTP/UDP/IP, UDP/IP, ESP/IP, IP	0x0101, 0x0102, 0x0103, 0x0104	RFC 5225

The Effnet ROHC product portfolio can be optionally complemented with a test environment, *Effnet HC-Sim™,* which can simulate IP traffic on configurable link conditions, e.g. bit errors, packet loss, reordering etc.

Standards Compliance

- IETF standards
    - RFC 3095 "RObust Header Compression (ROHC)"
    - RFC 3843 "RObust Header Compression (ROHC): A Compression Profile for IP"
    - RFC 4815 "RObust Header Compression (ROHC): Corrections and Clarifications to RFC 3095"
    - RFC 4995 "The RObust Header Compression (ROHC) Framework"
    - RFC 4996 "RObust Header Compression (ROHC): A Profile for TCP/IP (ROHC-TCP)"
    - RFC 4997 "Formal Notation for RObust Header Compression (ROHC-FN)"
    - RFC 5225 "RObust Header Compression Version 2 (ROHCv2): Profiles for RTP, UDP, IP, ESP and UDP-Lite"

Standards referral

- IETF standards
    - RFC 3241 "ROHC over PPP"
    - RFC 3759 "RObust Header Compression (ROHC): Terminology and Channel Mapping Examples"
    - RFC 3816 "Definitions of Managed Objects for RObust Header Compression"
    - RFC 4224 "RObust Header Compression (ROHC): ROHC over Channels that can Reorder Packets"
- Other standards
    - 3GPP TS 25.323, TS 36.323 Packet Data Convergence Protocol (PDCP)
    - 3GPP TS 44.065 SubNetwork Dependent Convergence Protocol (SNDCP)
    - Compliant with 3GPP IP based Multimedia Service (IMS) requirements
    - Compliant with 3GPP Multimedia Broadcast Multicast Service (MBMS) requirements
    - Compliant with 3GPP2 : CDMA2000 EV-DO Rev A

Portability and ease of integration

Effnet's ROHC product portfolio has been ported to and integrated on many different platforms. The operating systems include VxWorks, Nucleus, Linux, Windows (2000/XP), Solaris, FreeBSD and processors include PowerPC, MIPS, ARM, SPARC and x86. The products can be easily ported to many other operating systems, both real-time and generic as well as to other processors, both 32-bit and 64-bit regardless of byte-order.

- Highly portable code
    - is written in ANSI C, alignment safe and endianess independent.
    - has variable types defined such that the variables behave the same way across different compilers.
    - does not require OS timers and does not have OS dependencies.
- A well defined Application Programming Interface (API)
    - provides control of memory management.
    - provides control over multi-threading of the application with re-entrant functions.
- Small memory footprint and low CPU power requirement
    - makes it suitable for both mobile terminals as well as large system nodes like eNB.
- Interoperable
    - Has been extensively tested during field tests by customers, all the ROHC interoperability tests conducted by IETF and internal rigorous quality process.

Additional features
In addition to the features specified in the standards, the Effnet ROHC product portfolio has the following efficiency and robustness improving features:

- Full featured and efficient classification and context management module.
- Highly efficient compression and decompression using field pattern change detection algorithm and link layer information when available.
- Support for handover via context re-initialization.
- Support for AT reboot via feedback options, the decompressor reinstates the compressor context information.
- Mechanisms to reduce usage of feedback channel.
- Support for chained memory buffer.
- Interactive statistics and callback functions.
    - User can read and/or reset statistical information at desired time intervals. The callback functions provide useful state information.

- Dynamic channel parameter configuration.
- Adaptive mechanisms for improved compression efficiency & context damage detection under various channel conditions.
- List Compression and many of the channels and flow specific parameters, are highly configurable.

All additional features above are transparent with regard to interoperability.

Effnet Classifier and context manager

Packet classification and context management is essential to header compression. Effnet provides this additional module together with the Effnet ROHC product family.

Effnet ROHC^{TM}

The VoIP enabler on wireless networks! Effnet ROHC^{TM} is an important component to run VoIP services efficiently over wireless networks. Most of the RTP applications use UDP for signaling purposes and there are many stand-alone UDP applications, so the support for IP/UDP compression adds further to the efficiency. There is significant demand for secure exchange of information which leads to increased header overhead. The capability to compress IP/ESP, the header overhead in secure connections, makes it possible to run secure networks without additional bandwidth.

Effnet ROHC-IP^{TM}

As more and more networks are moving to support IP based communications, the number of nodes that require IP address are increasing rapidly. The introduction of IPv6 should address this concern but at least during transition time, a lot of traffic will be sent via tunnels across networks. Effnet ROHC-IP^{TM} is capable of compressing layers of IP headers thus making it possible to run tunneled traffic without need for additional bandwidth.

Effnet ROHC-TCP^{TM}

Multiple Internet packet size studies are in agreement that at least 40% of all IPv4 packets carry no or only a few bytes of payload i.e. packet sizes are at or very near to header size (IPv4+TCP). One study of IPv6 packets shows the same trend. Even more remarkable in that study is that for IPv6, 60-80% packets carry more header data than packet data. Effnet ROHC-TCP^{TM} would be very beneficial in these cases.

Effnet ROHCv2^{TM}

Mobility is the cornerstone of the cellular networks but supporting it efficiently is a tricky business. As the cellular network architectures have evolved, the integration point of ROHC in system nodes has moved closer towards mobile terminals for various reasons but has lead to a problem of handling reordering of packets during mobility. Effnet ROHCv2^{TM} addresses this concern very efficiently while providing high compression efficiency and robustness.

Maintenance and support
The Effnet ROHC product portfolio is offered with a full range of support services, including problem reporting, bug fixes, updates, training, consulting and integration services. A team of engineers experienced in standardization of header compression technology, implementation and testing of product portfolio is available for support and consulting services.

Licensing
For licensing of the Effnet ROHC product portfolio, complete or individual products, please contact us at info@effnet.com.