**Purpose**

*FastSat* is a network acceleration product targeted at satellite links but that can benefit to any link with similar characteristics.

The ultimate goal of *FastSat* is to optimise the use of the available bandwidth, to maximize the number of users supported and to reduce the delays experienced by these users.

**Overview**

At the foundation of *FastSat* is the Performance Enhancing Proxy (PEP). The purpose of the PEP is to dramatically improve the end-to-end TCP performance when traversing networks with long Latency, large Bandwidth Delay Product (BDP), high Bit Error Rate (BER), asymmetric Bandwidth Links or variable Bandwidth, which are exactly the conditions typical of multimedia satellite networks.

The PEP operates at the transport layer and is transport-layer transparent. It is distributed on both sides and is symmetric. It uses a split TCP connection approach.

A satellite link specific, highly optimised, Flight Protocol (FP) is used for the satellite link instead of the standard TCP protocol. Alternatively, an interoperable TP protocol can also be automatically selected.

Accurate Space Link Capacity Matching is provided on both sides to match the spacenlink capacity. To cope with the Bandwidth on Demand mechanism, the rate control parameters can be constantly and automatically adjusted according to the bandwidth variations.

To further optimise the available bandwidth usage and accelerate data transfer, sophisticated Adaptive Data Compression is provided on the satellite link to deliver the best compression ratio while not wasting processing power.

Similarly Web Page Acceleration has been introduced to mitigate the transmission delay experienced by the end-users when downloading complex Web pages. It relies onto an, inherently interoperable, single side pull approach. Requested pages are transparently intercepted and parsed, embedded objects required for page rendering are pre-fetched and cached on the Terminal side thereby anticipating on the subsequent browser requests and eliminating numerous round trip times.
**Architecture**

The PEP architecture is depicted in the figure below. It consists of two separate protocol stacks and several management applications.

- **Redundancy Manager**
- **Ether 1**
- **Ether 2**
- **PEP Mux**
- **UDP**
- **IP/ICMP**
- **IP*/ICMP**
- **TCP**
- **TCP**
- **FP**
- **Socket**
- **PEP Relay**
- **SNMP Agent**
- **WEB Agent**
- **SL Capacity Monitor**
- **HTTP Acceleration**

**Modes**

The PEP software operates in one of two modes: Router or Bridge.

In the Router mode, the PEP software forwards IP traffic between two interfaces belonging to two separate (sub)networks. The Gateway PEP is normally configured in Router mode.

In the Bridge mode, the PEP software forwards IP traffic between two interfaces belonging to the same (sub)network. The Terminal PEP is normally configured in Bridge mode.

**External Interfaces**

**Terminal**

The Terminal FastSat device is inserted in the chain of DVB-RCS equipment as illustrated below.

The Terminal FastSat has one traffic interface to the Hosts and an optional Router, and one traffic interface to the RCST.

Both the terrestrial and the satellite networks consist of Fast Ethernet LANs.

**Gateway**

The Gateway FastSat device is typically inserted in the chain of DVB-RCS equipment as illustrated above. Alternatively, it can also be remotely located at provider premises.

Each device of a redundant FastSat Gateway has one traffic interface to the IP Router and one traffic interface to the FLSS and the RLSS.

Both the terrestrial and the satellite networks consist of Fast Ethernet LANs.
Components

The FastSat software is mainly built on the following components:

- **Ethernet**
  This standard Fast Ethernet layer has been modified to interface the PEP Mux layer instead of the IP layer.

- **ARP**
  This standard ARP layer has been modified to provide Proxy ARP functionality on both interfaces of the Terminal PEP in order to implement the required bridge mode.

- **PEP Mux**
  The purpose of this new PEP specific layer is to multiplex incoming and outgoing IP packets between the two protocol stacks (native stack and PEP stack). This layer also provides Space Link Capacity Matching through rate control.

- **PEP IP** (also called IP*)
  This is a modified version of the standard IP layer. The main modification concerns the forwarding decision which is no longer based on the IP destination address but on the interface through which the packet entered the system.

- **PEP ICMP** (also called ICMP*)
  This modified version of the standard ICMP layer intercepts and processes some ICMP messages.

- **PEP TCP** (also called TCP*)
  This modified version of the standard TCP layer implements the TCP spoofing mechanism (i.e., interception of TCP connections) that is required to implement the split TCP connection approach.

- **FP**
  The Flight Protocol is at the core of the PEP. This is a brand new protocol that takes benefit from the point-to-point satellite link connection in order to optimise the use of the available bandwidth.

- **TP**
  The TP protocol can automatically be used as an alternate to the FP protocol on the satellite link (e.g., when the PEP on the opposite side is incompatible or disabled). It is used for interoperability with other vendors supporting SCPS-TP as defined by the Satlabs Group. It supports the SACK and SNACK policies.

- **PEP Relay**
  The role of this new PEP specific layer is to forward data traffic between the PEP TCP and FP or TP layers and to propagate connection management requests.

- **Space Link Capacity Monitor**
  On the Terminal side, the Space Link Capacity Monitor (SLCM) application is used in conjunction with the PEP Mux layer to provide accurate Space Link Capacity Matching. The role of this application is to monitor the status of the RCST output queue and to adjust rate control parameters accordingly.

- **FastSat Management**
  A FastSat device can be managed in many different ways. It can first be managed using commands entered from its local console, from a terminal console on one of its serial lines, or from any terminal emulator console on a Telnet connection.

  It can also be controlled and configured through SNMP. The standard MIB II is used for the native stack and an enterprise specific PEP MIB is used for the PEP stack.

  Last, it can also be managed through HTTPS using a standard Web Browser and a user friendly Graphical User Interface (GUI).

- **Redundancy Manager**
  On the Gateway FastSat, the Redundancy Manager application is responsible for the fault detection, state transfer, and fault recovery of the redundant FastSat.

- **HTTP Pre-fetching**
  HTTP pre-fetching consists in intercepting requested Web pages, identifying Web objects referred to by the Web pages, downloading these objects and pulling them into the Terminal cache in anticipation of the next user requests. This eliminates the need to wait for numerous round trip delays before the user can view a requested Web page with all its included objects.

- **HTTP Caching**
  HTTP caching caches Web pages together with pre-fetched objects. Pre-fetching and caching is intentionally limited to intra-page pre-fetching of embedded Web objects that are directly needed to render the requested pages. These objects are typically images, style sheets, frames, scripts, and applets.

- **IP and FP Compression**
  Data compression is implemented on IP or FP payloads to benefit to all traffic types. FP compression is moreover adaptive on a per connection basis to avoid wasting processing power when traffic is not compressible or compression time exceeds transmission time of the uncompressed traffic.
Performance Characteristics

Terminal
The Terminal FastSat software is able to forward traffic (i.e. large packets) between its two interfaces at a sustained speed of 8 Mbps in the forward link direction and 2 Mbps in the return link direction simultaneously.

Gateway
The Gateway FastSat software is able to forward traffic (i.e. large packets) between its two interfaces at a sustained speed of 40 Mbps in the forward link direction and 32 Mbps in the return link direction simultaneously.

Key Features
- Performance Enhancing Proxy (based on RFC 3135)
  - Transport-layer transparent
  - Split TCP connection
  - Optimized FP protocol for two way DVB-RCS satellite environment
  - Alternate interoperable SCPS-TP protocol.
  - Router and bridge modes
- Space link capacity matching (effectively allowing the use of VBDC on the Terminal side)
- Adaptive data compression (based on RFC 3173 and 2394)
- Web page acceleration with pre-fetching and caching on the Terminal side.
- Fault tolerance through warm passive redundancy on the Gateway side
- Manageable through both SNMP and HTTPS

Dimensioning
A maximum of 20,000 simultaneous end-to-end connections are supported by the PEP on the Gateway FastSat device.

The maximum simultaneous end-to-end connections supported on the Terminal side depends upon the available buffering space (it can typically be set to 1,200).

Packaging
The FastSat software can be provided already integrated in a network appliance or as software package that can be integrated in your own device. It is available both at kernel and at application level.

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It is believed that the content of this Data Sheet is correct at publishing time. As the product is constantly improved, future version might have slightly different characteristic and features.