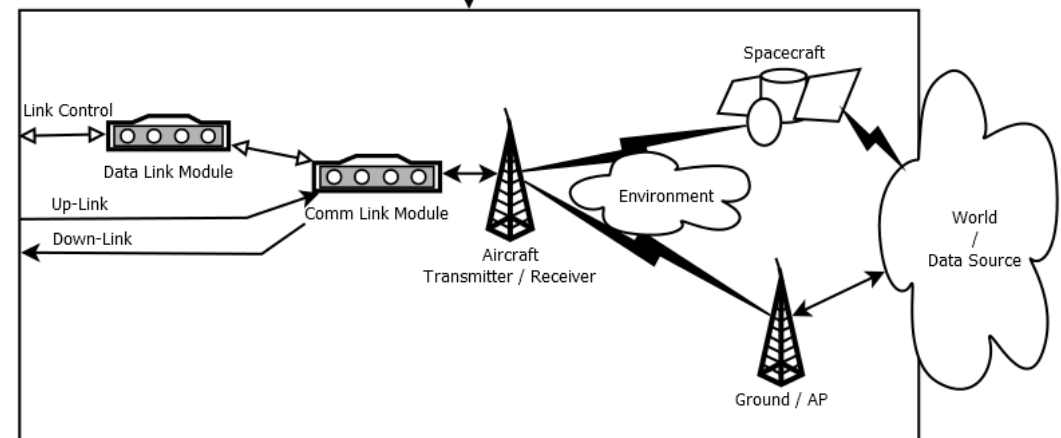
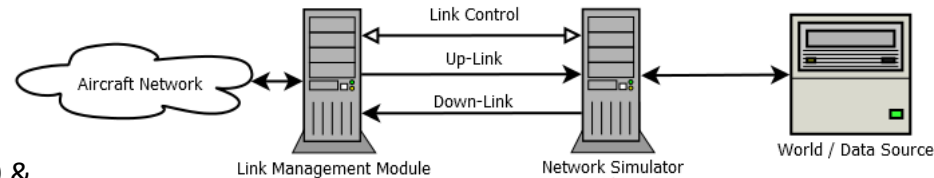
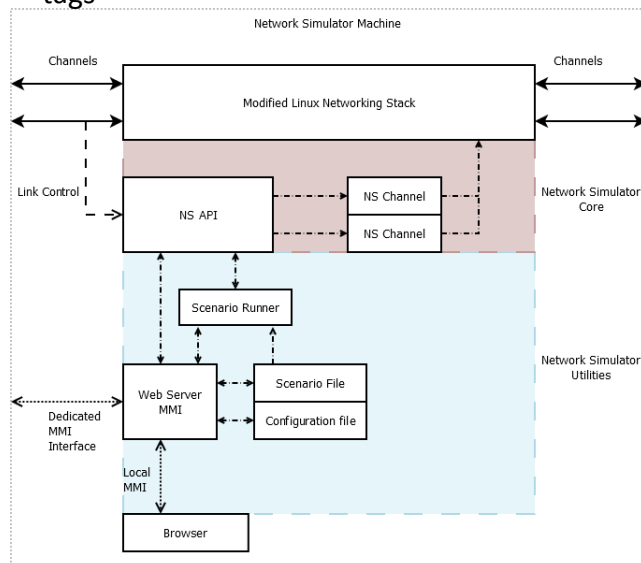


Objectives

- To provide with a real time simulation approach at the network level
- To be seen as a black box in place of the network it simulates
- To provide with similar performances and behaviors to the simulated network: networking quality of services (QoS), i.e. chiefly bandwidth, latency, jitter and loss.

Requirements summary

- Concurrent real-time simulation of at least 3 networks
- Operator-defined set of parameters capable of describing commonly used networks (3G/4G, SBB, HTS...)
- Capability of providing link control interfaces based on ARINC 839 & IEEE 802.21 / ARINC 781 specifications
- Scenario files to define simulation progress (QoS parameters)
- MMI for controlling the simulator by either local or remote operator (using a dedicated network interface)
- Changing the progress of running scenario by issuing new commands from the MMI
- Packet queuing and scheduling mechanisms based on their DSCP tags



Implementation

- Takes advantage of mature network simulation and routing routines included with Linux kernel
- Deployed with 10 Ethernet network interfaces, allowing simulation of 4 concurrent channels
- Ethernet interfaces are coupled into channels and assigned IP settings based on a MMI-generated configuration file
- MMI through a web server available both on local machine and through dedicated network interface
- Multi-threaded design takes maximum advantage of the used CPU in order to provide a stable performance across the simulated channels, regardless of their number
- Network Simulator Core and Scenario Runner are written in C



Network Simulator Overview

Channel Configuration

- Allows to quickly and easily set up a channel without need to manipulate any cables
- Determines DSCP mapping to classes of service
- Determines IP preferences
- Channel templates created automatically (based on devices count)

Scenario

- Specifies the zero-condition network parameters and their evolution in time

Easy scenario creation

- Only cells that indicate changes need to be filled
- 'Semaphore' feature to check data validity on the fly
- Provides a well arranged overview of the already defined changes with capability of filtering displayed data
- Encourages reuse of previous work

Monitoring

- Simulation window displays progress of the running scenario along with the currently set network parameters and provides basic network statistics
- The MMI also gives the operator detailed status of network interfaces available to the Network Simulator

The screenshot displays the ASHLEY Network Simulator interface, divided into several main sections:

- Configuration Window:** Shows settings for three channels. Channel-02 is configured with NLC type. It includes sections for AIRCRAFT NETWORK and SPACECRAFT NETWORK, each with Name, MAC, ID, IP, and Broadcast fields. Below, 'Classes of Services' are defined with CoS id, description, DSCP, MASK, and Priority.
- Scenario Window:** Shows a scenario named 'test.scr' with a time filter and a list of directives (e.g., 00:00:00.001 2P, 00:00:00.500 2P).
- Simulation Window:** Shows the simulation progress at 4444 ms. It includes a 'Directive' table for CH2 and a 'Network' table showing link bandwidth statistics for various interfaces.

Network Table Data:

S	R	T	Link Bandwidth [bps]		Direction		UnClassified
			RTN	FWD	RTN	FWD	
ALL	TP	498785	ALL	TP	12325719		
ALL	AB	7426	ALL	AB	8360		
ALL	AP	0	ALL	AP	0		
IP	TP	498125	IP	TP	12325257		
IP	AB	0	IP	AB	0		
IP	AP	0	IP	AP	0		
PPP	TP	498715	PPP	TP	12329887		
PPP	AB	0	PPP	AB	0		
PPP	AP	0	PPP	AP	0		