E-CONNECT'S FALCON APPLICATION FOR HIGH-SPEED VEHICLE CONNECTIVITY

Vehicles need to be connected in the modern world. E-Connect has a long heritage in IP connected vehicles and now it has produced a new generation of lightning-fast portable software that takes advantage of the latest mobile technology to allow any vehicle to be securely connected with any appropriate hardware.

The next generation in mobile routers

In the past connected vehicles needed a complex mixture of hardware and software to optimise a mixture of awkward and slow mobile technologies. But these technologies have now been replaced by high-speed LTE networks with sophisticated modems and in-built backwards compatibility. There is no longer any need to load your mobile router with thousands of lines of legacy software for outdated technologies.

The E-Connect FALCON (**F**ast **A**nd **L**ight **CON**nectivty) Application is a new software defined mobile wireless router application that can switch between and aggregate multiple modems. It supports the latest LTE Advanced networks and runs on any appropriate hardware including low-cost ARM solutions. FALCON is flexible and highly configurable providing both redundancy and increased speed to vehicle passengers and operators.

FALCON
the Fast And Light CONnectivity App for Vehicles
from Elemental Connect

Architecture

The system architecture is, in normal operating mode, client/server with the mobile router acting as the on-vehicle client and a software core router as server at the network management centre. Customers can choose whether to own and operate their own core router or use one provided as a service by Elemental Connect. A client-only version of FALCON, without a core router, is also available.

> **FALCON is a software defined mobile wireless router application.**

What hardware does it require?

FALCON is hardware agnostic, running on many different devices from standard computers and industrial PCs through to small-board and mobile computers. It is equally at home installed on-board proprietary vehicle computers as it is on a Raspberry Pi. Designed to run cool with little demand on CPUs, the software will run on INTEL x86 and ARM based processors using a Linux operating system.

The system does not support legacy 3G or older 4G modules, for example category 3 LTE is not supported. LTE modules with category 6 or higher ratings are supported, for example the Sierra Wireless MC7455.

System Sizing and Implementation

The sizing of the system depends upon the chosen hardware platform. The FALCON application imposes no limit on the number of modems per client or the number of clients per core router. Elemental Connect is happy to advise on the selection and suitability of hardware and to provide support in determining whether the selected platform will meet current and future needs.

Future Proofing

FALCON is designed as highly portable software which can be easily modified and updated. One specific objective in this is to avoid burdensome legacy code which slows down both operation and development. We are committed to maintaining a core code-base which will be continuously adapted as technology develops so that we can move seamlessly into the 5G era.

Management and Performance Monitoring

Throughput and other system parameters can be observed through the mobile router's web interface while the mobile router is being used. It is possible, for example to use a laptop to begin downloading a large file while, on the same laptop, simultaneously observing the mobile interface's graph showing real-time throughput on each physical network interface and also the virtual "tunnel" interfaces.

Management and reporting is completely centralised with all functions available via the Core Router web interface.

Security

Data between the Mobile router and the Core router is protected from end to end with the 128 bit security inherent in LTE.

Changing from Existing Mobile Router Solutions

There are many reasons to switch from legacy mobile router solutions to FALCON including:
- Higher throughput speeds
- Reduced CPU loads
- Reduced power consumption
- Lower complexity software

On vehicles space for equipment can be hard to find. FALCON is designed to run on a wide range of hardware, including many much smaller devices than existing mobile router solutions. Customers seeking to upgrade from existing solutions can therefore save space, or operate using the same physical envelope.

Elemental Connect calls has huge experience of fitting mobile routers on trains and can offer a comprehensive design service in support of your upgrade.

Specifications

The FALCON mobile router (client) system comprises 4 layers:

1) The base Linux distribution chosen using the following criteria:
   - supports hardware platform CPU architecture
   - mature system with large user base and long term support
   - provides 4.9 or higher Linux Kernel

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2) EConnect customisation of the Linux distribution
- remove unnecessary modules
- install required modules
- edit, re-write or replace base modules to support FALCON software
3) FALCON client
- manage all network interfaces
- manage routing of all network traffic passing through the mobile router
- monitor network interface and routing status for changes
4) FALCON web interface
- configure client designation
- configure server IP
- configure APN (optional)
- monitor system (CPU, Memory Usage, Network Traffic, etc)

The FALCON core router (server) system comprises 4 layers:
1) The base Linux distribution
2) EConnect customisation of the Linux distribution
3) FALCON software server
4) FALCON web interface
- server network interface configuration
- tunnel configuration
- define mobile router types
- define mobile router interface names & functions
- define mobile router interface related details (dhcp server subnet, WiFi SSID, etc)
- assign mobile router types based on designation

All FALCON core software is coded in C with some support shell scripts (BASH, DASH, CSH). All FALCON supplementary software (web interface) in either Javascript or BOA.

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