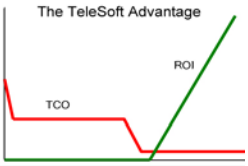
TeleSoft International

Protocols for Developers



Proven advanced starting points

TsLink3 Multi-Link Frame Relay SDK — Source Code Stack

TsLink3 Multi-Link Frame Relay

Multi-Link Frame Relay (MFR) Software Development Kit (SDK) allows the multiplexing of multiple virtual circuits on a single T1 physical pipe to optimize resources. Frame Relay networks can support multiple logical software bundles – each software bundle can have a different physical and logical bandwidth.

MFR is defined by two Frame Relay Forum standards, FRF.15 and FRF.16.1. These standards bridge the T1 (1.544 Mbit/sec) to T3 (45 Mbit/sec) bandwidth gap by providing scalable frame relay access at speeds between T1 and T3 at a significantly lower cost than leasing a full T3 line.

MFR aggregates multiple T1 circuits into a multilink bundle, fragments the frame relay frames into sub-frames, and transports the sub-frames over multiple T1 circuits in parallel. At the other end of the data pipeline, the sub-frames are reassembled into the original format. MFR allows the sub-frames to be reassembled and sent out in the original transmission order.

FRF.15 defines the end-to-end multilink service to combine the bandwidth from multiple permanent virtual circuits (PVCs) to provide a high-capacity, aggregated PVC between two points.

FRF.16.1 (UNI/NNI Multilink) provides the User-to-Network and Network-to-Network Interface management structure defining the primitives used between the application and the TsLink3 MFR software stack.

Features

TeleSoft MFR provides a compact, high performance source code module:

- Developed for embedded applications
- Compact memory size
- Flexible, full-featured core
- User and Network Sides
- PVC and SVC Support
- OS independent
- FRF AND ITU-T Standards-based
- Written in ANSI C for portability

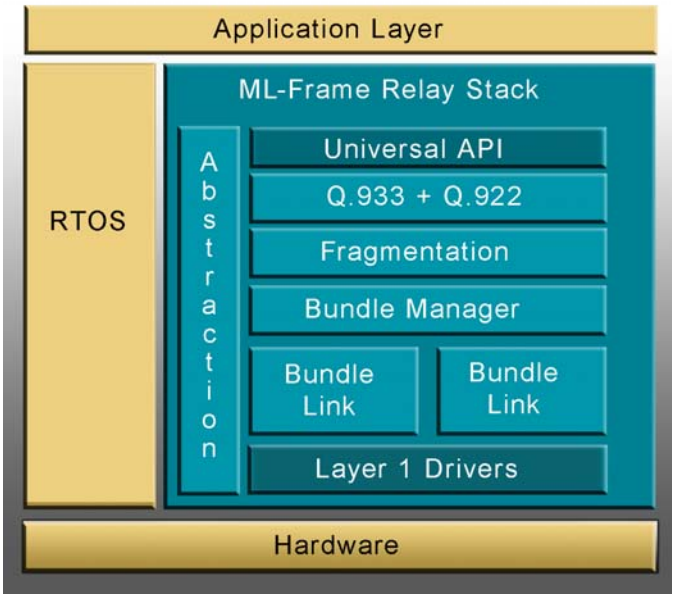
Applications

TeleSoft MFR is designed for use in multiple Frame Relay signaling applications:

- Base stations
- Digital loop carrier systems
- Networking of remote digital equipment
- Switches
- Intelligent networks
- Interconnecting servers

Standards supported

- FRF.1.1
- FRF.2.2 - NNI
- FRF.3.2 – RFC 2427 encapsulation
- FRF.4.1 – Q.933 Case A for PVC and SVC
- FRF.5 – Frame Relay/ATM Interworking
- FRF.12 – Fragmentation and Reassembly
- FRF.15 – End-to-End Multi-link Frame Relay
- FRF.16.1 – MFR for UNI/NNI support



Multi-Link Frame Relay Block Diagram

TeleSoft MFR Features

Supports provide Multi-link and Fragmentation services.

- Fragmentation services allow real-time and non-real time data to co-exist on Frame Relay links.
- Multi-link services allow aggregating the bandwidth of several links into one virtual link.
  - Fragmentation may be enabled End-to-End, UNI/NNI, or both
  - Multi-link may be enabled End-to-End, UNI/NNI, or both
  - Fragment size set by configurable constants.
  - Both services may be used in ISDN or non-ISDN environments.

Services are individually enabled to allow use in a mixed interface environment

- Permanent Virtual Circuits (PVCs) & Switched Virtual Circuits (SVCs) per FRF4
- DTE (User) Side + DCE (Network) Side (PVC only)
- Dynamic run-time configuration with Forum Local Management Interface (LMI)
- Network Management Interfaces conform with ITU-T Primitive Interfaces
- Q.933 Annex A and T1.617 Annex D PVC
- Modular structure easy to customize using defined constants
- Higher-layer independence allows transparent transport of other protocols, including:
  - TCP/IP ,SNA, X.25/X.75 & ISDN
- Supports testing both sides of the network
- Layer 2 DL-CORE Module
- DTE & DCE Side implementation of Data Link - CORE and LMI functions
- Functions supported include:
  - Congestion Control and Explicit Congestion Notification (ECN)
  - Data Link Connection ID (DLCI), up to 922 users
  - Multicast-configurable to network needs
  - Discard Eligibility bit
  - Heartbeat Process to verify physical link integrity
- 1024 PVC DLCIs for support of up to 255 active connections

TeleSoft MFR provides a broad development and debugging environment:

- Sample applications to demonstrate use of the Universal API.
- Ports are available for Linux, VxWorks, OSE, Nucleus Plus and MQX OSes.
- Sample make files and imake scripts.
- Internal Protocol State Logging Tool and Debugging Tool are invaluable aids during integration.
- Debugging & auditing features allow compile-time & run-time details for logging of messages & events.

TeleSoft Advantages

TsLink3 software stacks are specifically architected for all types of embedded and host-based applications and are optimized for excellent performance and small code size.

Written in ANSI C and delivered as source code SDKs with a pre-ported interface to a defined RTOS of your choice, TsLink3 stacks give you an advanced starting point to shorten your development schedule, minimize technical risk and maintain the flexibility to exercise full control over your end product.

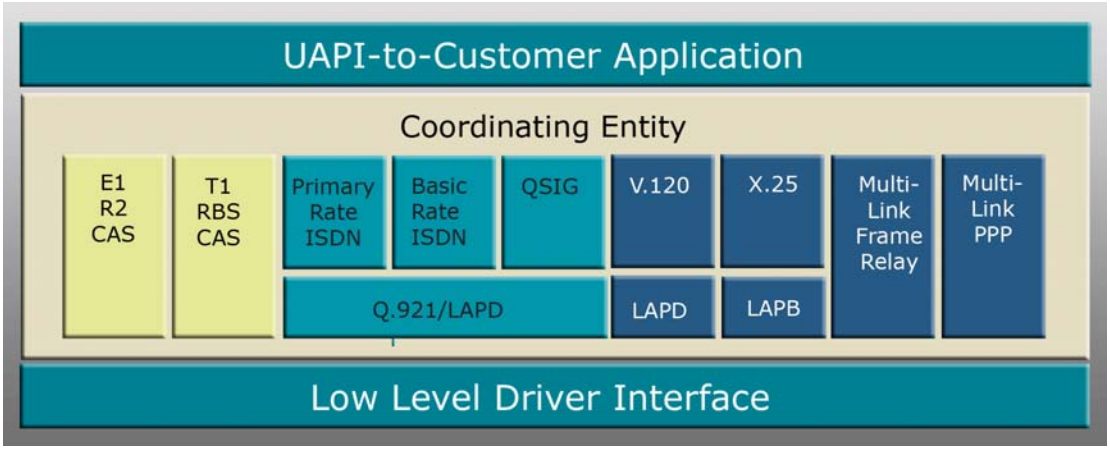
All TsLink3 protocol software stacks are based on a Standard Core Architecture (SCA) with a Universal API (UAPI) that enables easy migration between different stacks and portability to different software/hardware platforms.

Universal Application Programming Interface (UAPI)

TsLink3 code includes a rich message-based Universal API (UAPI) which presents a simple interface for simple applications such as signaling-only. UAPI also provides the versatility and power needed to support more complex configurations which combine signaling with data protocols or with specialized hardware. The TsLink3 Universal API coupled with the straightforward structure of the TsLink3 protocol stack enables you to easily follow the API message flow through the code to determine where to make modifications required for your application.

The majority of simple signaling-only applications require a very small subset of the TsLink3 API messages and parameters - and the non-applicable messages can be disregarded and unused parameters set to zero. More complex applications benefit from the large set of messages and parameters that we provide as templates.

UAPI is common across all TeleSoft stacks which decreases the time and effort required to add upgrade modules to an existing TsLink3 stack and to develop with additional TeleSoft stacks.



Software Tools

Internal Protocol State Logging Tool and Debugging Tool are invaluable aids during portation and integration, included with every TsLink3 stack at no additional charge.

Purchasing TsLink3 Software

TsLink3 Source Code is supplied in comprehensive, portable packages of 'C' source code modules and interfaces necessary to develop robust products. Source Code packages provide source code from Layer 1 device driver software up through the Layer 3/Layer 4 interface of the OSI model.

Cost-effective one-time licensing fee; no royalties or user-fees for TsLink3 source code.

Upgrade and Individual Modules

Completing the solution are upgrade- and individual-modules that increase your market opportunity by increasing your products' connectivity capabilities. Modules include PPP, ML-PPP, X.25, AO/DI, Frame Relay, T1 RBS, E1 CAS, R2, V.120, and Supplementary Services.

Well-Structured, Maintainable Code

Maintainability and scalability are designed into each TsLink3 stack. Comprehensive comments and documentation support you as your product goes forward. The value of TsLink3 stacks will be evident in each phase of your engineering schedule and the product life span.

Shorter Learning Curve & Faster Customization

- ITU-T primitives and software structure – make it easy to relate TsLink3 code to other ITU-T based protocols.
- ETSI/ECMA compliant code - ensures interoperation with other equipment (e.g., PBX) that is ETSI/ECMA compliant.
- 'C' switch statements that closely correspond to the ITU-T standard - straightforward to read and modify code, and locate the event/state action points in the ITU-T standard.
- Adherence to ANSI 'C' standards – provides for full portability.
- OS-independence - choice of RTOS, not locked into a single vendor.
- Processor-independence - enables mobility across CPU platforms.
- Simple state machine design - easy to understand and change code for national specific variants.
- Consult with our experienced engineers early to avoid expensive pitfalls later.

Faster debugging

- Specific defined constants, comment strings and variable naming - supports use of text search techniques to quickly locate a specific section of code and determine the side effects of changes that are being considered.
- ITU-T primitives and software structure - clear traceable dataflow.
- Development and testing on TsLink3 hardware - clean, proven and robust code.

Smaller inventory

- Each line can be configured at run-time for a different T1, E1, R2, PRI or BRI variant
- Co-resident T1, E1, R2, ISDN PRI and BRI switch variants, Frame Relay, X.25, PPP, and ML-PPP stacks.

Documentation

Comprehensive documentation customized for your load. Provided in a searchable soft format. All nomenclature complies with ITU-T.

Technical and Custom Support

3-months included with each license. 12-month maintenance extensions include code updates and quick-response technical support via E-mail, phone and fax.

About TeleSoft International

TeleSoft International, Inc., is an industry-leading, US-based provider of field-proven, scalable, standards-based protocol stacks for developers. We specialize in telecom applications, licensing source code stacks to OEMs and ODMs worldwide for VoIP, ISDN, Q.931, Q.921, QSIG, Supplementary Services, ML-PPP, PPP, Frame Relay, T1 RBS, E1 CAS R2, and X.25.

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