

# Product Engineering Services

## LTE UE Stack

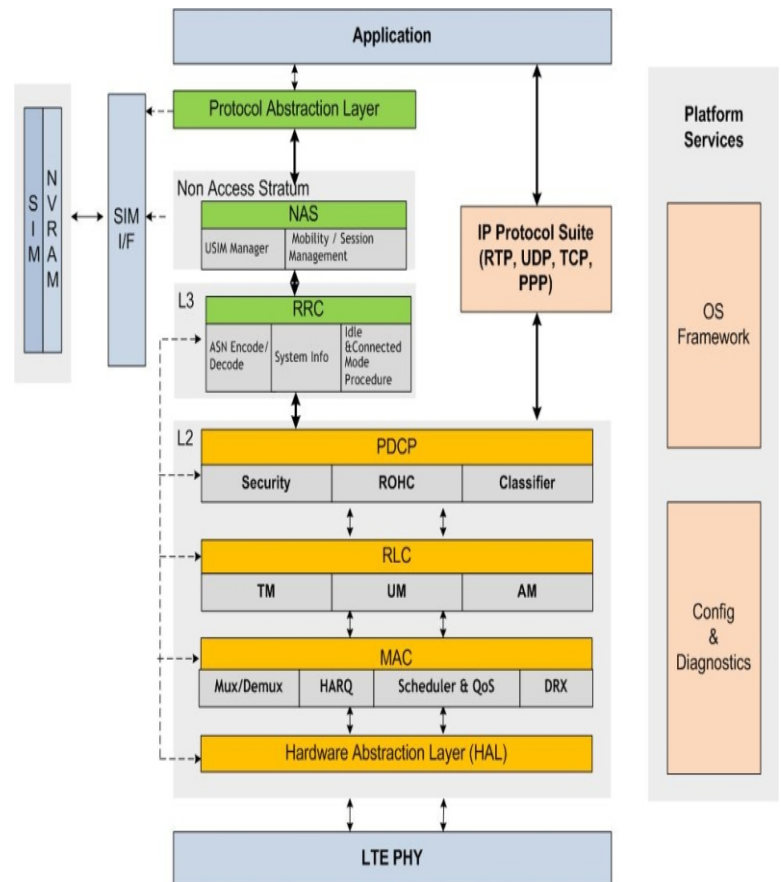


L&T Infotech offers a complete LTE UE (User Equipment) Stack Implementation consisting of L2, L3 and NAS layers that are fully optimized for the ARM Target Platform. Our LTE UE Stack offers a low foot print, high performance and throughput to meet the high data rates of a LTE UE Class, and is intended for devices such as standalone / multi-mode / tethered mode wireless handsets, data cards, USB Wireless Modems, laptops and Ultra Mobile PCs.

### Product Feature Set

- Compliant to 3GPP Release 8 Specifications (March 2009 Release)
- Modular architecture for flexibility to accommodate evolving standards
- Well defined API's between Protocol and application layer for easy development/interoperability with 3rd party applications
- OS agnostic Protocol Stack, Modular architecture and well defined MAC-PHY interface APIs aids in the portability across different hardware platforms
- Well defined NAS-RRC interface for facilitating quick integration to existing NAS in multi-mode architecture
- Data plane and control plane differentiation for easy porting of Data plane to Kernel mode, micro engines depending on the platform in use.
- Optimized buffer handling model in data plane for better throughput
- Support for power saving schemes and reduced processor utilization
- Framework for fine tuning QoS Mechanisms and Flow control
- Optimized Encoder-Decoder library
- Comprehensive and user friendly diagnostic and debug framework
- Watch Dog support for sanity and recovery mechanisms
- Well defined API's between Protocol and application layer for easy development/interoperability with 3rd party applications
- Verification testing with eNodeB simulator using 36.523 UE conformance test suites and third party UE testers

### Architecture



### Project Deliverables

- Complete C/C++ source code for core protocol components
- Framework wrapper for target RTOS/platform
- Comprehensive Documentation for System Architecture, MAC-PHY APIs and OS Framework
- Product customization and integration support services

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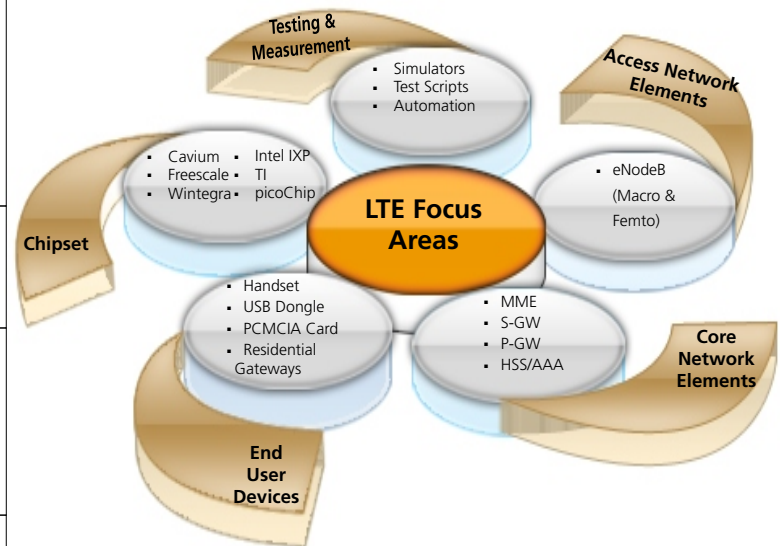
Modules	Features
MAC	<ul style="list-style-type: none"> <li>▪ Random Access Procedure</li> <li>▪ Maintenance of Uplink Time Alignment</li> <li>▪ MUX/DEMUX</li> <li>▪ HARQ</li> <li>▪ DL/UL SCH Data Tx</li> <li>▪ PCH/BCH Reception</li> <li>▪ DRX</li> <li>▪ MAC Reset &amp; Reconfiguration</li> </ul>
RLC	<ul style="list-style-type: none"> <li>▪ Support for Entities:TM, UM and AM</li> <li>▪ ARQ Procedure</li> <li>▪ SDU Discard Procedure</li> <li>▪ RLC re-establishment Procedure</li> </ul>
PDCP	<ul style="list-style-type: none"> <li>▪ Data Transfer Procedures</li> <li>▪ Re-establishment Procedure</li> <li>▪ Header Compression and Decompression</li> <li>▪ Ciphering and Deciphering</li> <li>▪ Integrity Protection and verification</li> <li>▪ PDCP Status Report</li> <li>▪ PDCP Discard</li> </ul>
RRC	<ul style="list-style-type: none"> <li>▪ System Information</li> <li>▪ RRC Connection Control(Establishment/Re-Establishment, Paging,Security activation,Re-configuration,Connection Release, Radio Resource Configuration,Radio Link Failure related actions)</li> <li>▪ Measurements NAS Message Encapsulation (UL/DL Info Transfer)Inter-RAT Mobility</li> </ul>
AS Idle Mode Procedures	<ul style="list-style-type: none"> <li>▪ PLMN Selection</li> <li>▪ Cell Selection and re-selection</li> <li>▪ Cell Reservation and Access Restriction</li> <li>▪ Tracking Area Registration</li> <li>▪ Reception of Broadcast information</li> <li>▪ Paging</li> </ul>
NAS	<ul style="list-style-type: none"> <li>▪ Registration and De-registration</li> <li>▪ Authentication</li> <li>▪ NAS Ciphering</li> <li>▪ NAS Integrity</li> <li>▪ E2E bearer setup</li> <li>▪ IP address allocation</li> <li>▪ Paging support</li> <li>▪ Mobility Management</li> <li>▪ UE initiated Attach/Detach</li> <li>▪ NW initiated Attach/Detach</li> <li>▪ Tracking Area Update Procedure</li> <li>▪ NAS Idle Mode Procedures</li> </ul>

## About L&T Infotech

L&T Infotech, a wholly-owned subsidiary of the \$7 Billion Larsen & Toubro group, is a provider of IT & Technology solutions and services to global clients across industry segments encompassing Telecom, Manufacturing, Banking, Finance, Securities, Insurance, Energy & Petrochemicals. L&T Infotech delivers high fidelity solutions based on time-tested institutionalized processes and a deep-rooted belief that quality is a cost-saver. Accredited with the prestigious SEI CMMi LEVEL 5 certification, its motto is **“Quality Drives Productivity”**.

L&T Infotech’s vision is to provide world-class services to clients in its areas of focus, offering solutions that are based on business and technology insights.

## LTE Focus Areas



## Unique Service Differentiators

- Hardware Expertise on Handset includes: ARM 9, ARM 11, MIPS and PowerPC
- Experience of integrating wireless stacks with PHY implementation
- End-to-end Design and Implementation Experience on various Mobile Handset based Platforms and OS frameworks
- Experience in protocol stack development, stack adaptation, IOT and Field Test experience on various wireless technologies including UMTS, CDMA, WiMAX, etc for leading Tier 1 and Tier 2 Telecom Vendors

## Quality Certifications



## Product Engineering Services (PES) - Telecom

The Product Engineering Services Group at L&T Infotech has a proven track record of developing and deploying telecom technologies, products, applications and platforms for renowned telecom players across the globe. We provide software and hardware engineering services to leading OEMs, ODMs, chipset vendors, Telecom carriers and ISVs. We support clients in the areas of chip design, hardware design, firmware, middleware, software engineering, applications & content all the way from design, development to deployment.

## Our Telecom Domain Expertise spans across

- Infrastructure
- Mobile Devices
- Entertainment Technology
- Computing & Data Networking
- Test & Validation
- VLSI Design
- Hardware & Platform