HCL

MECHANICAL
& EMBEDDED
SERVICES

INTRODUCTION

Reducing the associated cost, size, and complexities for process innovation becomes highly significant. HCL deliver next-generation systems engineering and embedded software solutions that help overcome these business challenges.

Through IPs, we ensure embedded development which includes embedded middleware, rich embedded system applications, and interactive GUIs for consumer electronics, computer peripherals, Kiosks and telecom products. Our embedded systems group comprises software engineers/developers with a skill set ranging from microprocessors to real-time operating systems, delivering next-gen embedded engineering solutions.

OUR PRODUCT LIFECYCLE SERVICES INCLUDE:

NEW PRODUCT DEVELOPMENT:	NEW PRODUCT ADAPTATION	PRODUCT SUSTENANCE	TESTING AND VERIFICATION
Feasibility study, embedded software architecture, modeling, embedded systems design, embedded systems software engineering, embedded systems software programming, embedded software development systems, release management, and feature driven development	Embedded system software service including re-development and re-engineering of embedded software and systems, latest technology adaptation, custom embedded system software development, performance and reliability improvement, and multiple platform porting services	Lifecycle enhancements, defect tracking and fixing, feature enhancements, regression testing, and maintenance releases	Test plan design, embedded system design, test automation and scripting, compatibility and interoperability, compliance testing, and regression testing

HCL LEADERSHIP IN DOCUMENT AND PRINT INDUSTRY

CLIENTS

- Working with 5 of top 10 document and print product development companies

- 12+ years experience with customers in document and print product development companies

- Handling complex programs Greater than 25 million lines of code

- LCD Panel Drivers, MFP architecture improvement Design, Embedded UI applications, Device Level Interfaces, Board Design

- Mechanical Design

- Document Management, Workflow Management, SDK, MPS Solutions
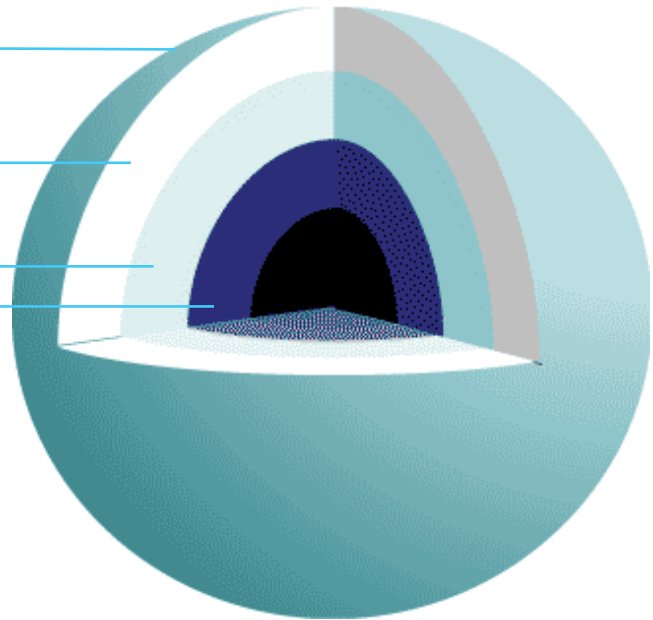
- Image Processing, Color Sciences, Xerography

DOMAIN

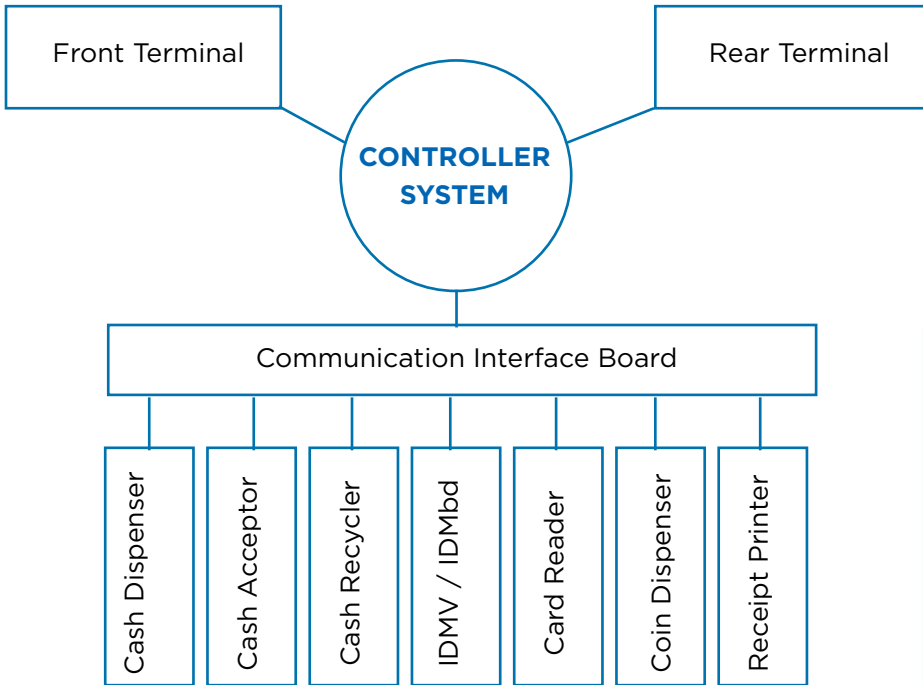**LEADING SERVICE PROVIDER IN DOCUMENT & PRINT TECHNOLOGY**

PROCESS

- SEI CMM Level 4/5 centers

- ISO 9001/27001 certified

- Agile Based Development

PEOPLE

- 2000+ person years of experience in developing Software, firmware, Mechanical & hardware for MFPs

DOCUMENT & PRINT TECHNOLOGY – SERVICE OFFERINGS

Front Terminal		Rear Terminal

CONTROLLER SYSTEM

Communication Interface Board

- Cash Dispenser
- Cash Acceptor
- Cash Recycler
- IDMV / IDMbd
- Card Reader
- Coin Dispenser
- Receipt Printer

SERVICES

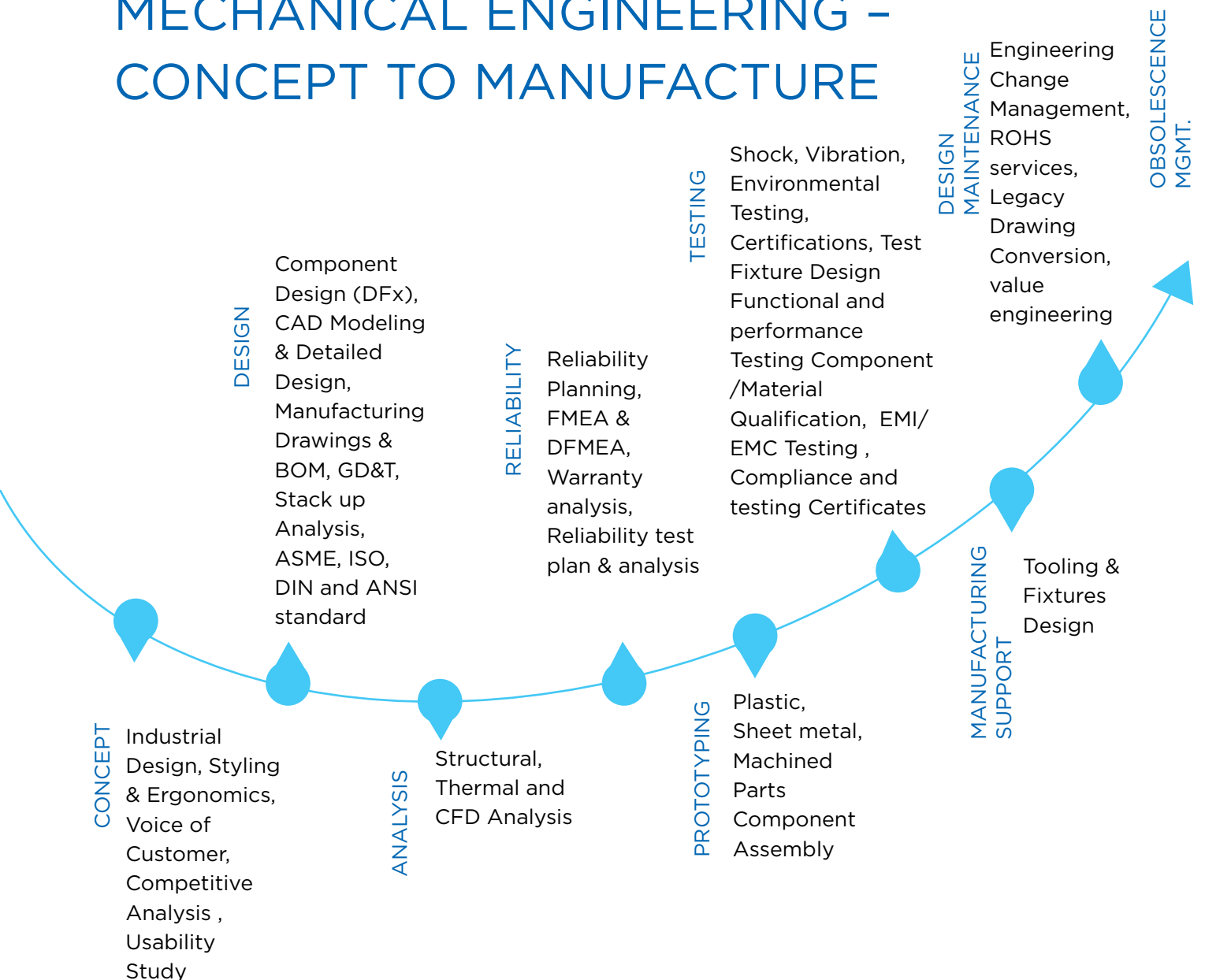| Firmware	Software	V&V
Module Development	Terminal Application	Test Automation
Driver Development	Mobile Apps	Build Services
Communication Protocol	Cloud Services	Triage
OS Porting/ Customization	XFS Manager	RGT/EGT Support
Driver Development	Security Software	Module Testing
Remote Services	Simulator	Test Tool Development
Diagnostics/Tool	Tool Development	
Device Services	Device Services	
Imaging	DB Services	
Sustenance		

MECHANICAL ENGINEERING

Due to rising costs and mounting margin pressures, manufacturing design and mechanical design companies are expanding to optimize their product engineering and R&D services, shorten product development timelines and gain early advantage.
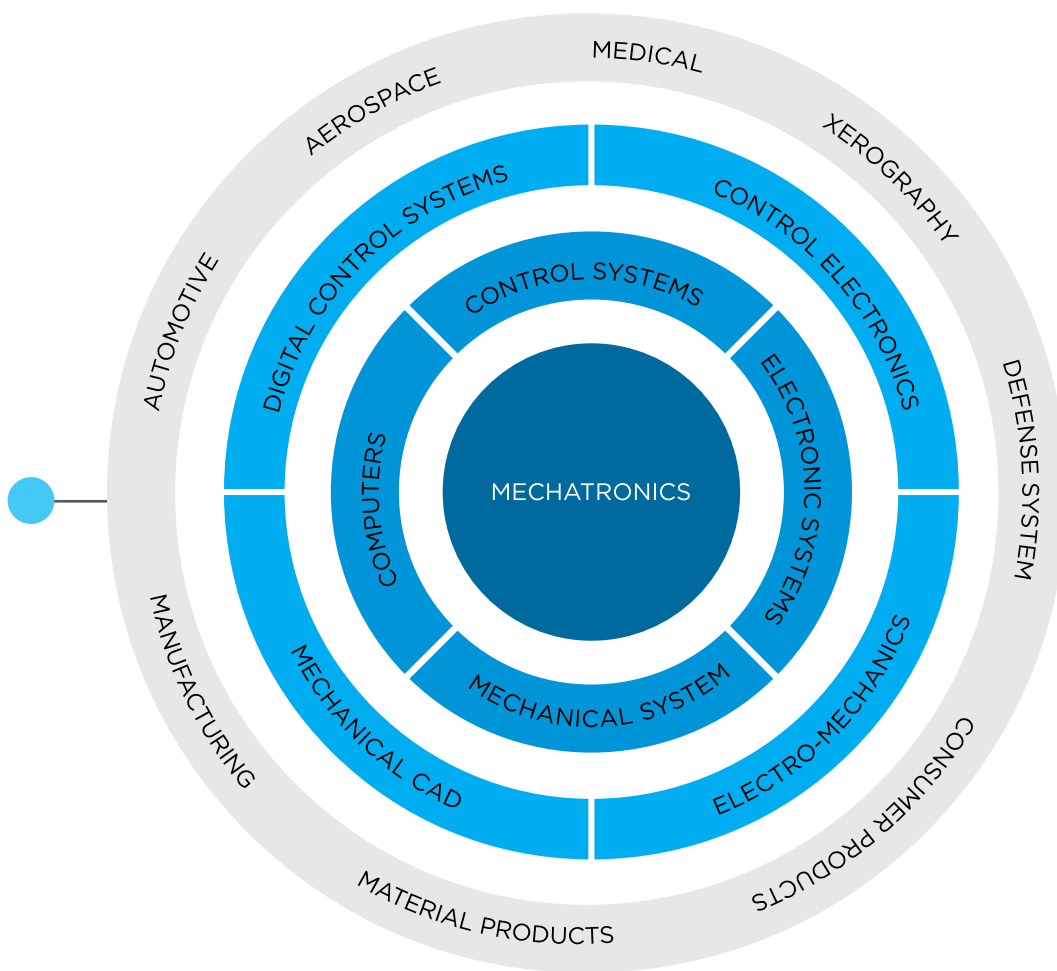
We offer advanced mechanical engineering solutions as well as mechanical engineering design services to mechanical design engineering companies across multiple industries. These mechanical engineering services facilitate complex mechanical designs and products development, reduce time-to-market, and B2B market penetration for a mechanical design company.

We are a one-stop solutions provider with capabilities throughout the product development lifecycle, ranging from conceptual design to manufacturing.

MECHANICAL ENGINEERING – CONCEPT TO MANUFACTURE

CONCEPT
Industrial Design, Styling & Ergonomics, Voice of Customer, Competitive Analysis , Usability Study

DESIGN
Component Design (DFx), CAD Modeling & Detailed Design, Manufacturing Drawings & BOM, GD&T, Stack up Analysis, ASME, ISO, DIN and ANSI standard

ANALYSIS
Structural, Thermal and CFD Analysis

RELIABILITY
Reliability Planning, FMEA & DFMEA, Warranty analysis, Reliability test plan & analysis

PROTOTYPING
Plastic, Sheet metal, Machined Parts Component Assembly

TESTING
Shock, Vibration, Environmental Testing, Certifications, Test Fixture Design Functional and performance Testing Component /Material Qualification, EMI/ EMC Testing , Compliance and testing Certificates

MANUFACTURING SUPPORT
Tooling & Fixtures Design

DESIGN MAINTENANCE
Engineering Change Management, ROHS services, Legacy Drawing Conversion, value engineering

OBSOLESCENCE MGMT.

MECHATRONICS SYSTEMS EXPERTISE AREAS

Mechatronics expertise diagram

- MECHATRONICS (center)
- CONTROL SYSTEMS
- ELECTRONIC SYSTEMS
- MECHANICAL SYSTEM
- COMPUTERS
- DIGITAL CONTROL SYSTEMS
- CONTROL ELECTRONICS
- ELECTRO-MECHANICS
- MECHANICAL CAD

Industry segments: MEDICAL, AEROSPACE, XEROGRAPHY, AUTOMOTIVE, DEFENSE SYSTEM, CONSUMER PRODUCTS, MANUFACTURING, MATERIAL PRODUCTS

RELIABILITY ENGINEERING

Reliability growth management : Analysis, Prediction and Reporting from Product conception – Market Launch – Field Support – Value Engineering

Module or system problem identification testing.

Environmental stress testing.

Focussed module or system stress testing.

Accelerated life testing.

Combinatorial testing.

Product verification/ demonstration testing

Reliasoft Weibull++ 7 & RGA 7

Welded Sheet metal
Castings
Composite moulded plastics
Hinges, Slides Doors, Handles
UI, Keypads, Fans, Ducts
Docking, Operability
Product Integration
Manufacturing integration
Harnessing
DFA, DFE, VA/VE

STRUCTURES

EMBEDDED SOFTWARE

Operating System - RTOS, Linux, Windows
Communication - Ethernet, USB, RS232, Wi-Fi, RFID, FAX
Storage Interface – HDD, SD
GUI – LCD, Web
Control Algorithms
I/O Controls
Stepper/DC Motor Controls
Sensor Interface
Embedded Applications

SENSORS

Optoelectronic
Hall effect
Limit switch
Proximity – Magnetic, Infrared
Pressure
Temperature

IMAGING

Input Optics : CCD, CIS, FWA
LED Imaging
ROS Imaging
LED Illumination
Image Processing
Video Data Path
Media Handling

ELECTRONICS

Board design – Microcontroller, Multicore, FPGA
Interfaces – PCI, HD, Video
Motor Control
Solenoids, Relays

Material handling (Powder)
Control systems
Sensors :
Temperature
Humidity
Conductivity
Flow Resistivity
High Pressure & High Temperature fusing
Magnet Technologies
HV / Charge field control
Environmental Controls
Marking Systems

TECHNOLOGY

Motion /Position systems
Complex mechanisms
Motor solenoids
Clutches
Dynamic Flow Control
Feeding Elements
Stack Feeding
Media Finishing : folding, stapling, drilling, binding

MEDIA HANDLING

Motion Quality
Precision DC
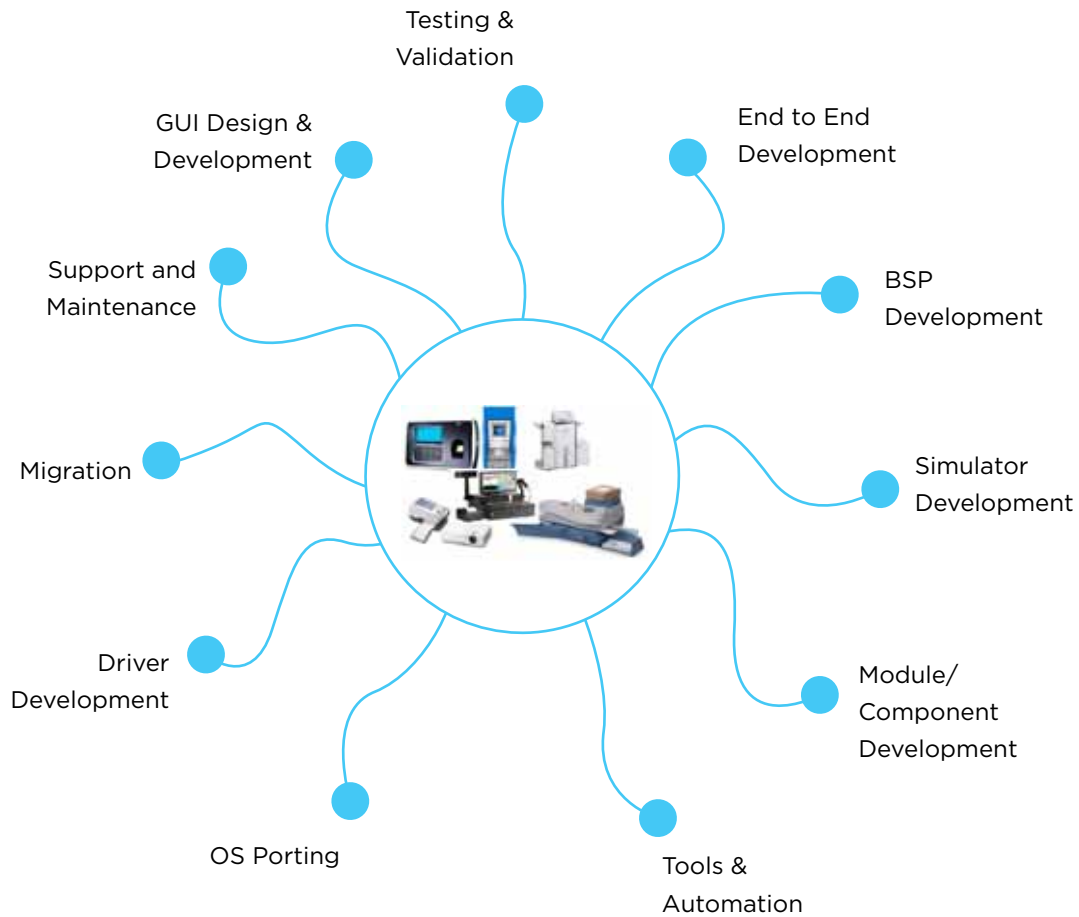Servo
Stepper Motors
Speed control
Precision gear sets

DRIVES

Simulation – MATLAB, LabVIEW, Recurdyne
PLM – Teamcenter, Windchill, Cockpit
Software – CleaCase, ClearQuest, GIT

SOFTWARE TOOLS

Low Voltage
High Voltage
Drive Circuit – Heating elements (Fuser)
Safety approval – CB, UL, CSA, KEMA

CUSTOM POWER SUPPLY

DOCUMENT & PRINT TECHNOLOGY - SERVICE OFFERINGS IN EMBEDDED SOFTWARE

Testing & Validation

GUI Design & Development

End to End Development

Support and Maintenance

BSP Development

Migration

Simulator Development

Driver Development

Module/ Component Development

OS Porting

Tools & Automation

EMBEDDED SOFTWARE ENGINEERING SERVICES SNAPSHOT

Services	Monitoring and Control Application (UI, Product specific application, Algorithm), Diagnostics, Remote Administration, System Monitoring	Specific to System Design and Control Service
Protocol	Device: I2C, SPI, Onewire, CAN Communication: USB, Serial, SSP, Bluetooth, IEEE1394 Networking: TCP/IP, NetBIOS, SMB, DSL, Cable Modem, NAT, IPP, FTP, Telnet, Rseries, VoIP, SMTP, POP3, SLIPP, PPP, x.25, FrameRelay, ATM, MPLS, ISDN, WAP, GSM, GPRS, 802.11x, SNMP, Virtual redirector	Proprietary Protocol Based Design need
Drivers	Audio, Touch Panel, LCD, DMA, IEEE1394, IrDA, Keyboard, USB (Host and Device), Networking (MAC, Phy, Switch, Controllers), PCI, Wireless, Proprietary Devices	Graphic Drivers File system Drivers
Kernel	VxWorks, OSEK, QNX, WinCE, Windows Xpe, pSOS, RT Kernel, Nucleus, Threadx, Various Flavors of Linux, DSPBIOS, ITRON, Superloop, HCL Multitasking Kernel	RTOS, open source and commercial
Bootloader	uBOOT, RedBoot, pmon, WinCE Boot, Grub, Lilo, XPE Loader, Vxwork bootloader, Winmon	Board specific from processor Vendors
Processors	Hitachi ARM PowerPC MIPS Intel SH3, SH4, ARM7, ARM9, PXA, OMAP 16K, 24K, x86, 16 & 32 SH5 ARM11, Cortex 32K bit controllers Other Micro Controllers M68K, Coldfire, Atmel, PIC, HCS08, HCS1	Special Purpose Processor Such as Networking & Multimedia)

Development is based on:

- Hands on experience
- Standard and Projects executed
- Architecture knowledge experience

HCL DIFFERENTIATORS

- HCL Tech heritage: Legacy of 40+ years of developing complex engineering products and designs for many mechanical engineering design company.

- Dedicated domain-specific practices

- End-to-end capabilities: Complete mechanical product design solutions for all requirements, from industrial design and mechanical engineering design services to CAE/CAM, documentation, prototyping, testing, and manufacturing.

- Proven expertise: In implementing efficient ECO solutions for complex equipment

- Cost benefits: Dedicated Offshore Development Centers (ODC) and domain-specific certified Testing Labs ensure reduced total cost of ownership, and full lifecycle services for mechanical design companies by providing cost savings of up to 45%.
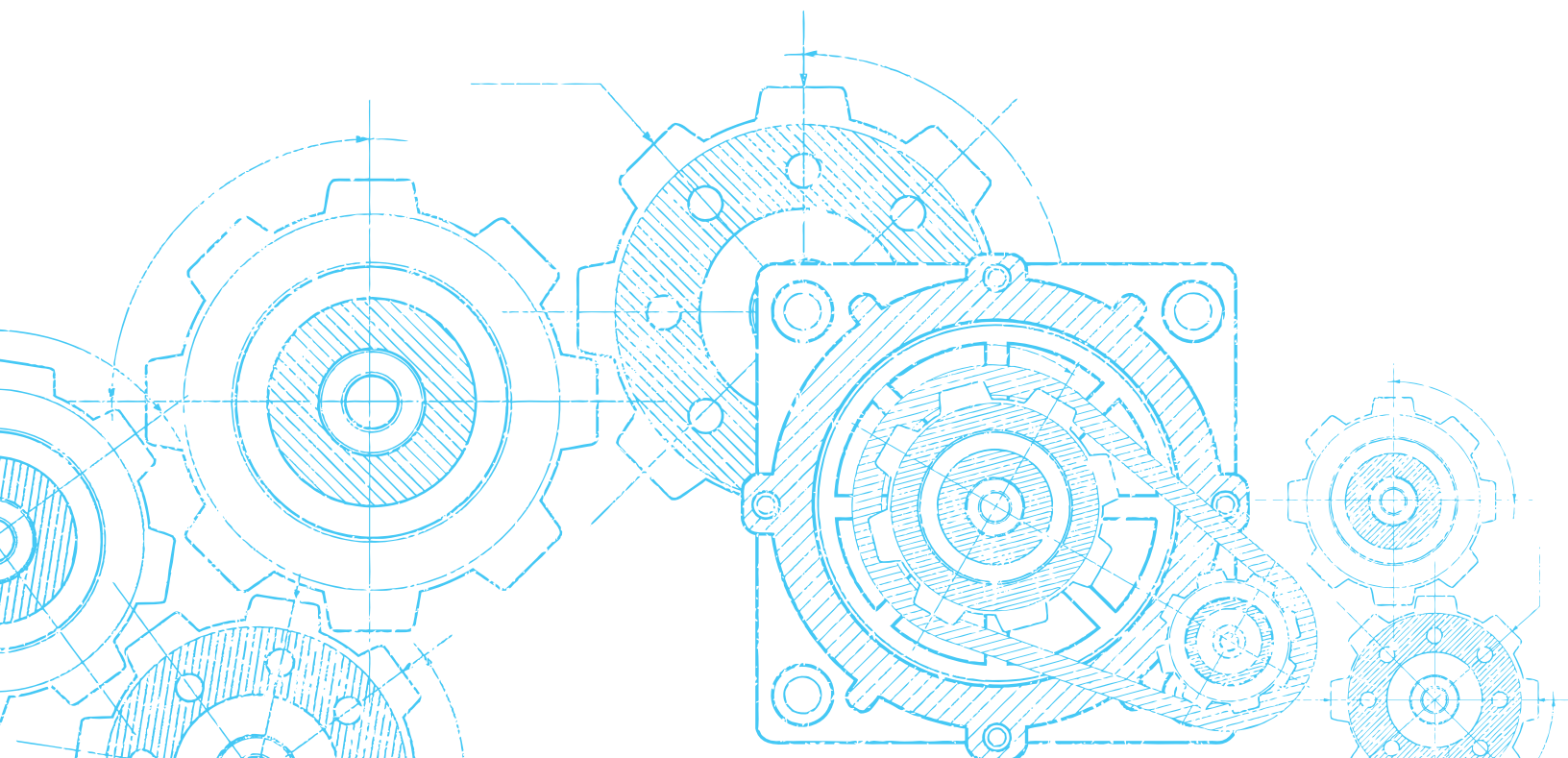
CASE STUDY #1: SELF SERVICE AND RENTAL RACK KIOSK ENGG. FOR A LEADING US BASED FLOOR CARE APPLIANCES MAKER (1/2)

BUSINESS PROBLEM STATEMENT

- Expensive product line with diminishing sales

- Customer started a new business model of product rental assisted by service person

- Looking for a fully automated solution to illuminate the need of service person

- Payment (PCI) and stores specific certifications
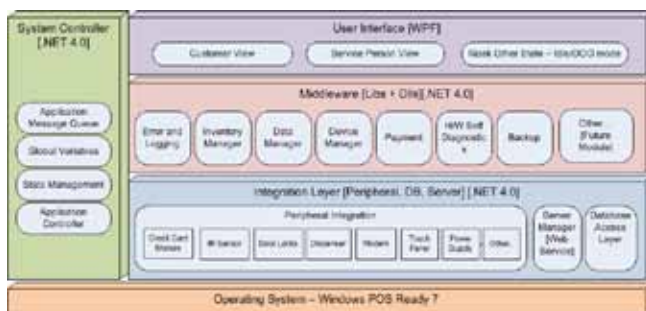
TECHNOLOGY / TOOLS / SPECS

- Windows POSReady 7

- .Net, WPF, WCF, SOAP

- C#

- MS Server, SQL

- SVN, BugZila

- Payment gateway integration

VALUE ADD

- Payment Gateway certification

- PCI / PS-DSS Compliance

- Selection of right credit card (CCT) hardware module - vendor analysis

- Execute in Agile

HCL SOLUTION & SCOPE OF WORK

- Design and Developed of Kiosk Solution

- ID and Mechanical design

- Hardware design and integration

- Kiosk and server application design

- Fully automated, self service Kiosks

  - Interactive Touch UI for Customer and Service person

  - Peripherals integration

    - Card Reader,

    - Bottle dispenser,

    - Electronics Locks,

    - Proximity sensor,

    - Barcode etc.

    - 3G/4G USB Dongles

- Server applications – User Management, Kiosk Management, Order Management Discount coupon and Royalty etc.

- Remote Kiosk Management

- Payment module & Gateway integration

- All sensitive data transport in a secured way – SSL, Data security - [symmetric key, AES256 bit]

PAYMENT SOLUTION INTEGRATION HIGHLIGHTS

- Selection of right credit card (CCT) hardware module - vendor analysis

- CCT Integration with Kiosk – device driver, application integration, mechanical design

- Support for different types of credit cards (visa, master, Discovery, pay pal)

- Integration with payment gateway – supporting various payment transactions

  - Pre-authorization, full and split settlements

  - Cancel / Refund payments

  - Handling of stolen, delayed rental scenarios

  - Profile management – not storing sensitive information

- Secure connectivity solution

  - SSL based secure connectivity using VeriSign certificate

  - Data security - [symmetric key, AES256 bit]

- Testing and Certification

  - Developed automation test application to test various payment scenarios

  - Payment Gateway certification

  - PCI / PS-DSS Compliance in roadmap

  - Store specific compliances (SRCR)
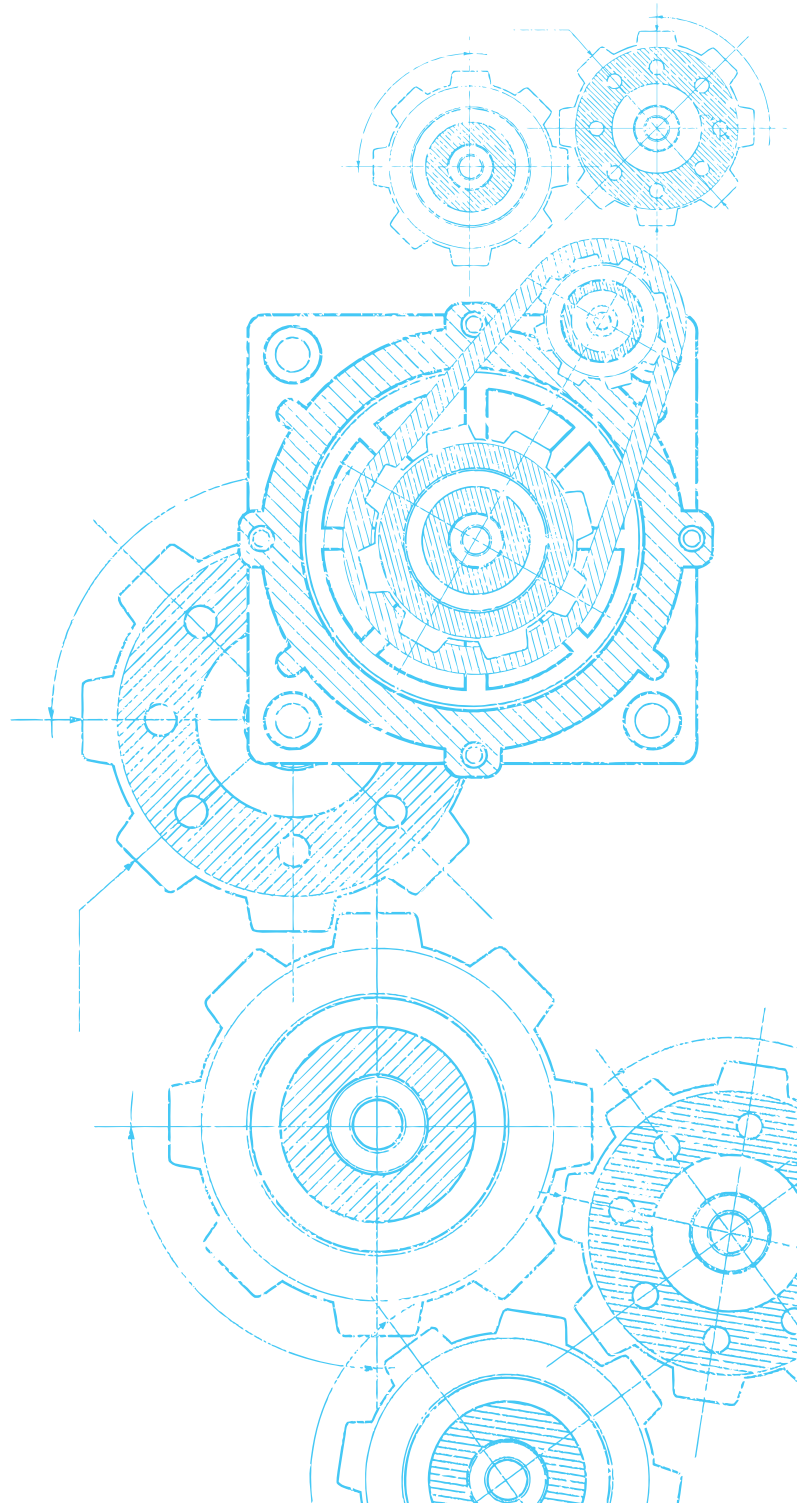
CASE STUDY #2: COIN SYSTEM DESIGN & DELIVERY MODEL

CLIENT

Leading Vending Machine Manufacturer

BUSINESS PROBLEM

Current vending system incorporates a coin payment system which is proprietary, in-house designed, high precision assembly and consequent cost making it uncompetitive

SCOPE

Design and Development of a new coin payment module

COIN INLET

COIN VERIFIER

COIN VAULT

COIN HOPPER

HCL SOLUTION

- Design proposal generated by HCL to utilise a range of newly designed assys and industry standard components integrated with some client custom components to produce a lower cost base design capable of being extended from a point product to a product family that can be integrated to various vending machine models. Thus has significantly reduced development costs, and provided a much wider market coverage whilst still maintaining all security and operability critical requirements

- Predictive engineering practices used to demonstrate reliability outlook to match either previous performance or concurred market requirements

- Regular progress reviews conducted by phone and face to face to validate status, engage all stakeholders, concur direction and ensure activity is on track

- Aggressive schedule to complete design, build and test 1st prototype using WGC in-house production and test facilities

- Product cost outlooks closely monitored to meet concurred targets and manufacturing transfer proposed and supported to move procurement and assys from a high cost location in Europe to a low cost environment in Asia

CASE STUDY #3: MFP REMOTE SERVICE COMPONENT DEVELOPMENT

SCOPE

Development and maintenance of Cloud enabled Remote Care module to diagnose and troubleshoot the MFP.
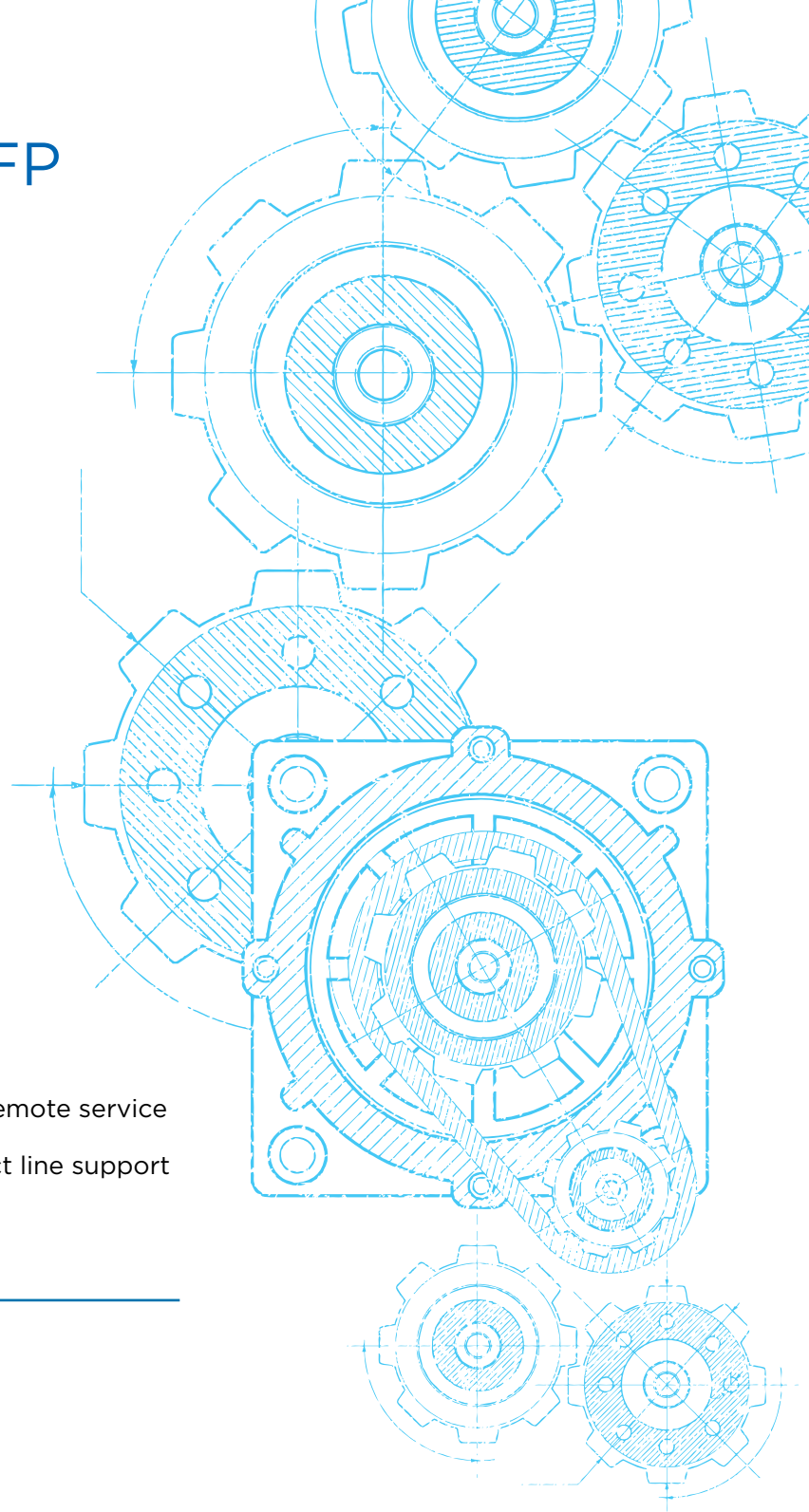
CLIENT

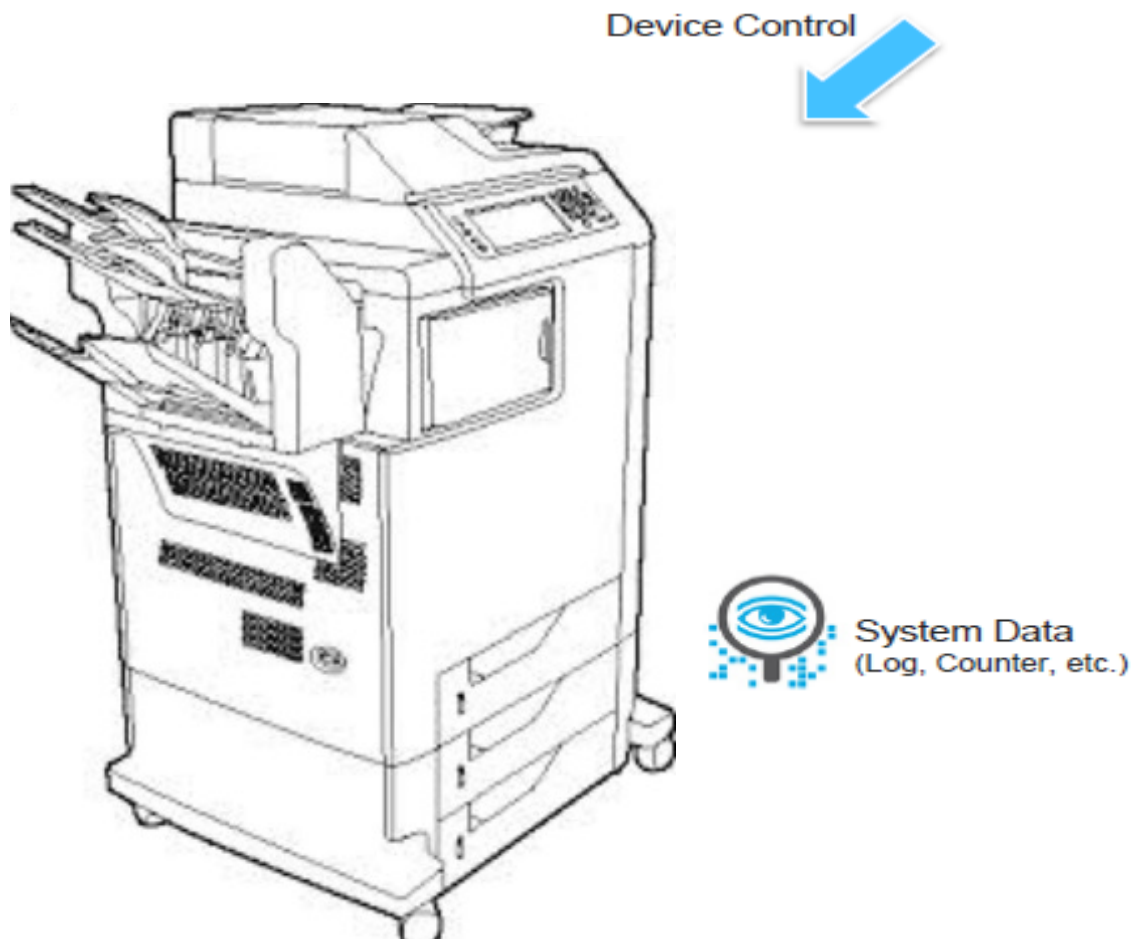Leading Multi Function Printer (MFP) Manufacturer

HCL APPROACH

- Onsite-Offshore Development Model

- Firmware team includes Web expertise for remote service

- Features provided with attributes for product line support

- Design to support mobile device access

TECHNOLOGY/TOOLS HIGHLIGHT

- SSI, CGI

- JavaScript, CSS

Device Control

System Data
(Log, Counter, etc.)

HCL SOLUTION

- Remote service settings and commands

- Enhancement of Finisher Status

- Enabling Device registration in service center through Web

- Automatic Transmission of system data (alerts, messages and counter readings)

- Designed to retrieve RAM data only via e-mail or fax connection to the service center COM server

- Development in-progress to send data that supports supply chain management system

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BEYOND THE CONTRACT

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