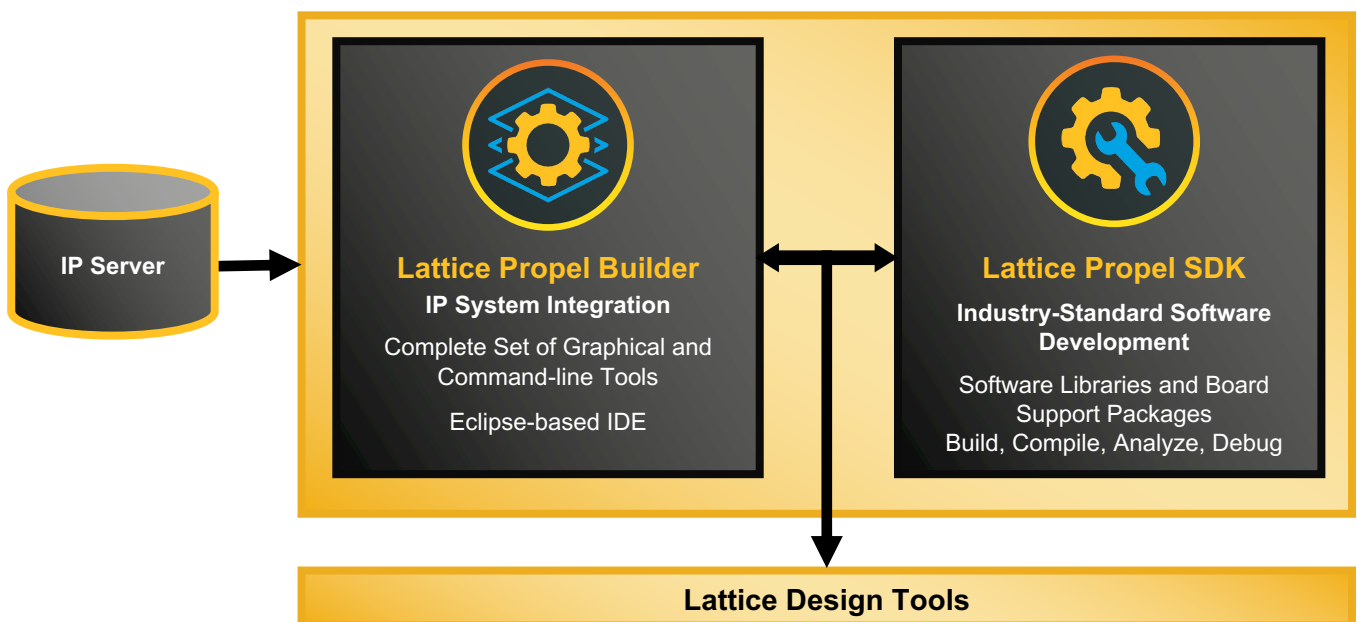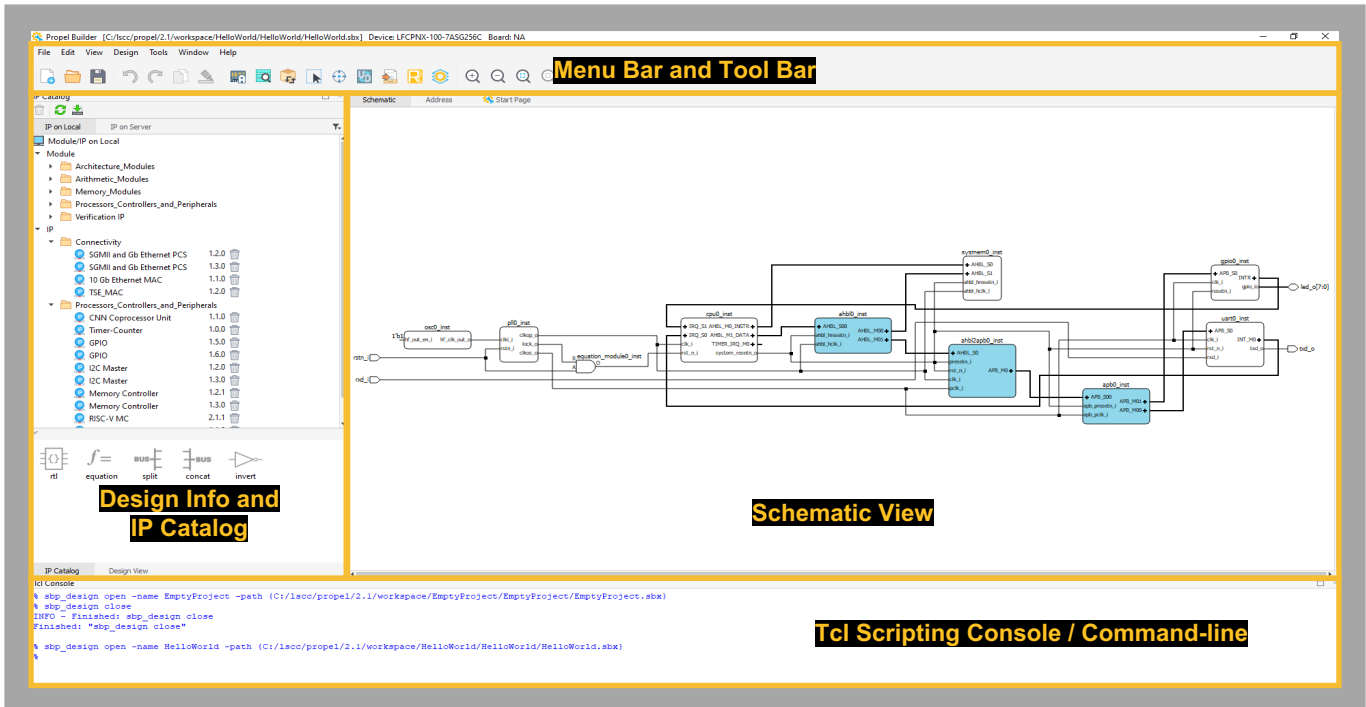# Build FPGA-Based Processor Systems in Minutes

FPGA designs are increasingly adapted to the ever-changing requirements of modern electronics. Among popular applications such as server platform security, artificial intelligence (AI), and embedded vision image processing, small form-factor FPGAs with processing capabilities have gained tremendous popularity. Small form-factor FPGA devices can quickly and easily be deployed for specialized applications with a combination of both high-speed digital logic and software-based control systems.
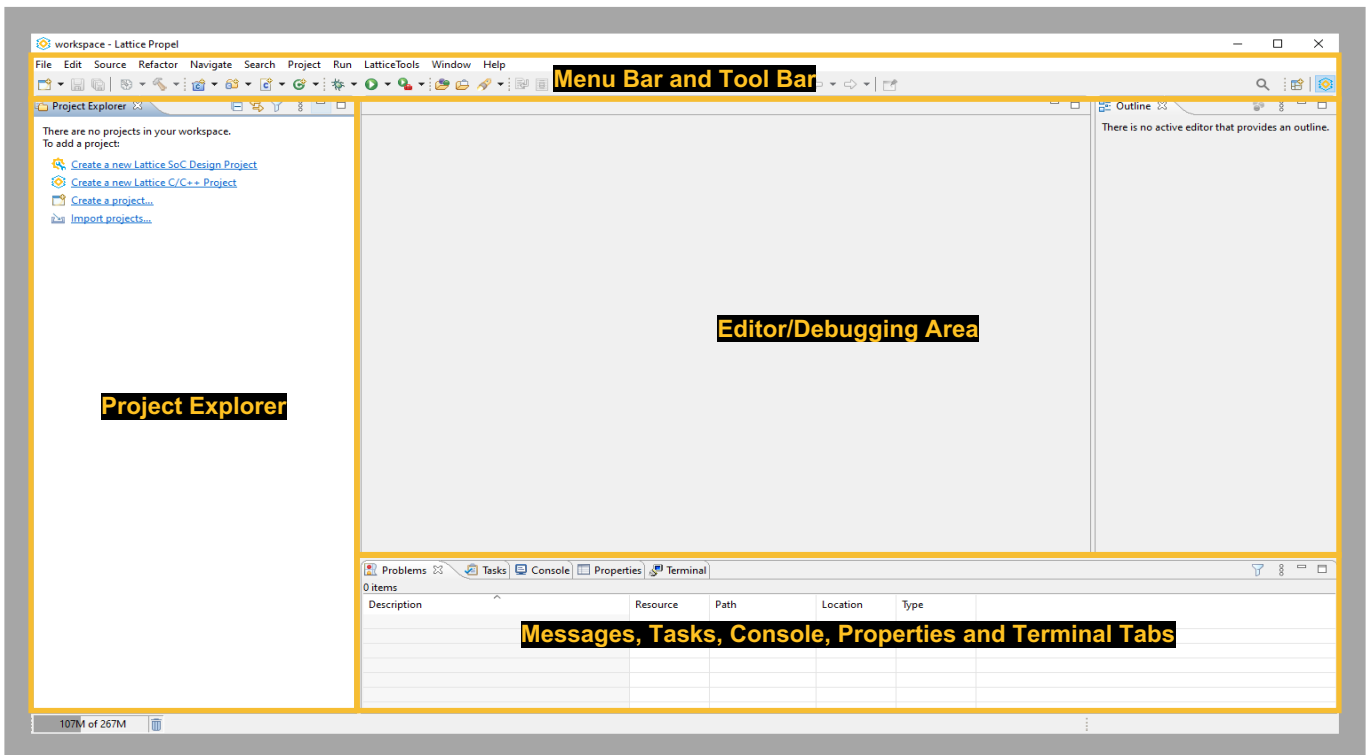
Lattice Propel is a complete set of graphical and command-line tools to create, analyze, compile, and debug both the hardware design of an FPGA-based processor system, and the software design for that processor system.

IP Server

Lattice Propel Builder
IP System Integration
Complete Set of Graphical and Command-line Tools
Eclipse-based IDE

Lattice Propel SDK
Industry-Standard Software Development
Software Libraries and Board Support Packages
Build, Compile, Analyze, Debug

Lattice Design Tools

Lattice Propel Builder Tool Interface

Menu Bar and Tool Bar

Design Info and IP Catalog

Schematic View

Tcl Scripting Console / Command-line

Lattice Propel SDK Tool Interface

Menu Bar and Tool Bar

Project Explorer

Editor/Debugging Area

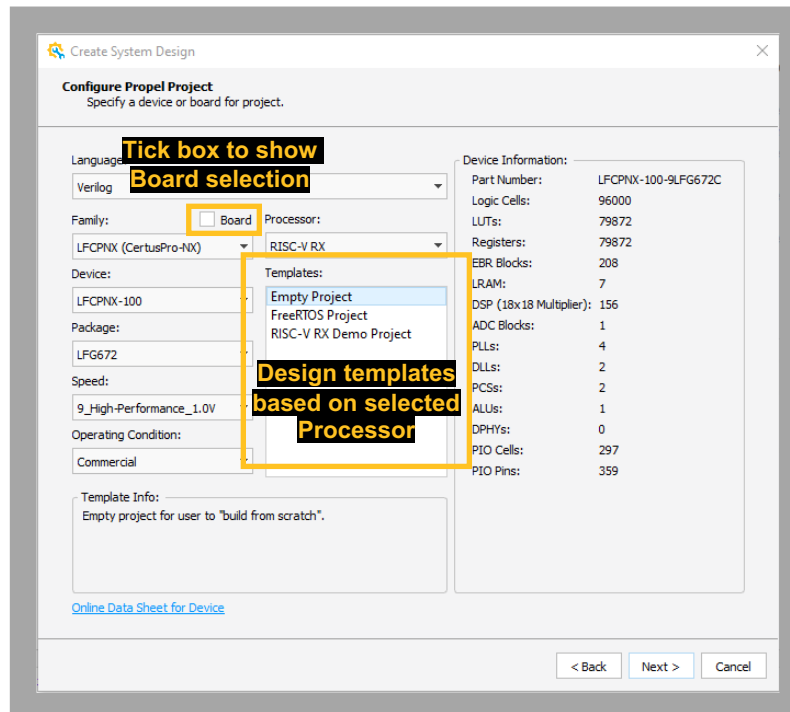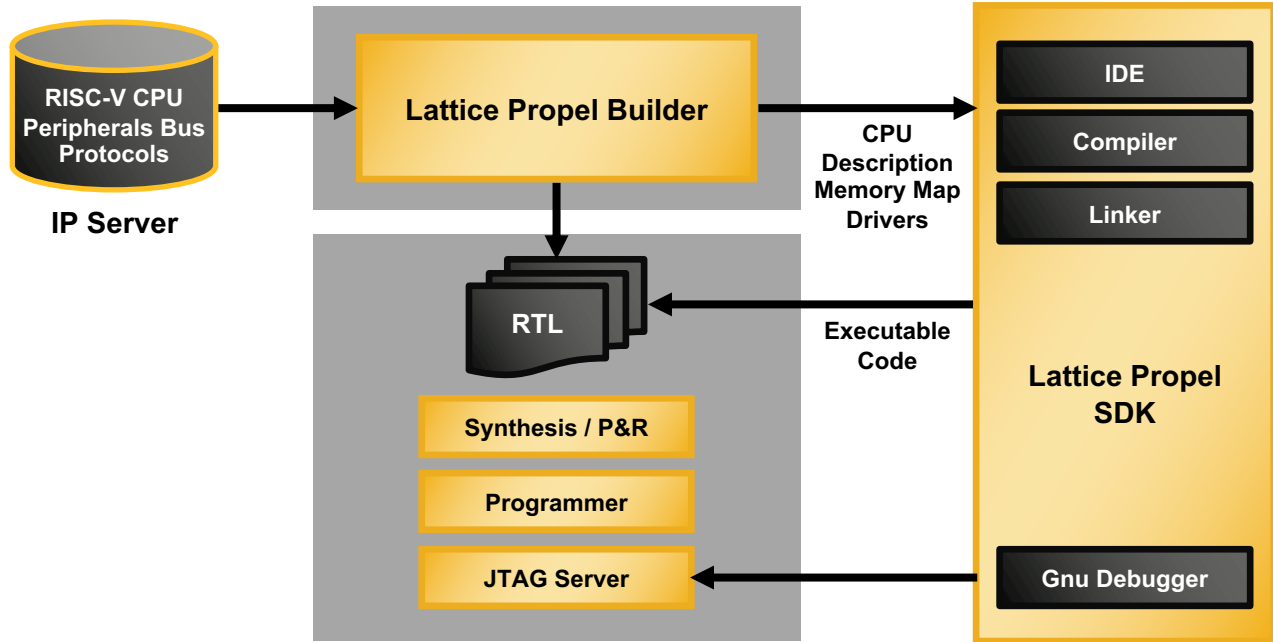**Messages, Tasks, Console, Properties and Terminal Tabs**

IP Packager Tool
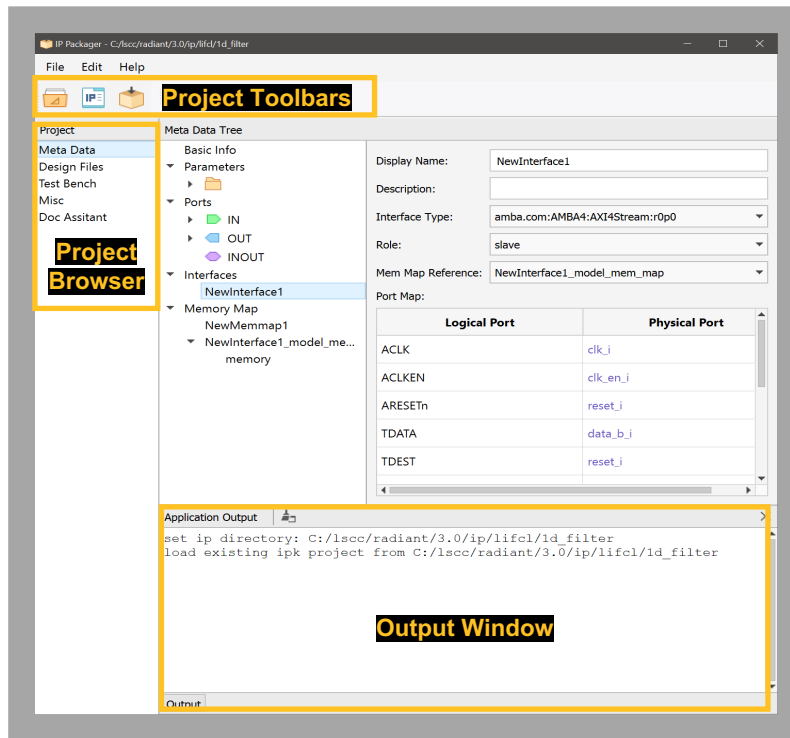
- Package IP for import into Propel Builder and Radiant
- Include drivers, testbench files and constraints
- Doc Assistant to create HTML
- Add Interface (AMBA)
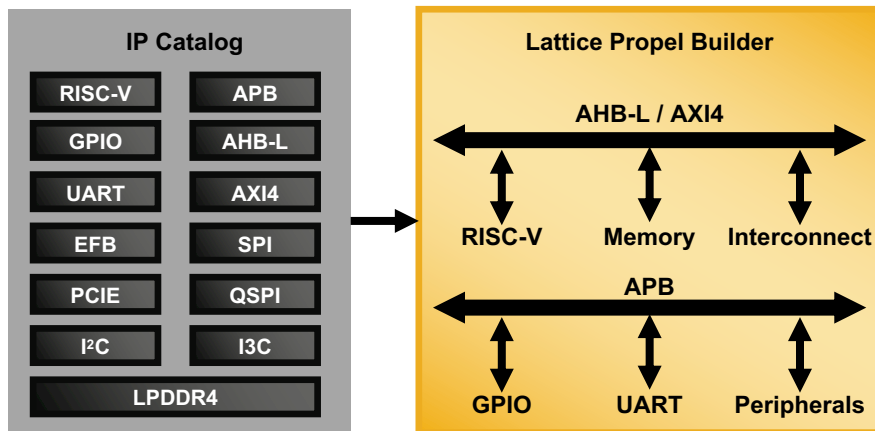- Import Memory Map
- IP Preview

Built-in Project Templates

Lattice Propel Design Environment Block Diagram

RISC-V CPU
Peripherals Bus
Protocols

IP Server

Lattice Propel Builder

RTL

Synthesis / P&R

Programmer

JTAG Server

CPU
Description
Memory Map
Drivers

Executable
Code

IDE

Compiler

Linker

**Lattice Propel
SDK**

Gnu Debugger

Lattice Propel Builder Design Flow

IP Catalog

RISC-V	APB
GPIO	AHB-L
UART	AXI4
EFB	SPI
PCIE	QSPI
I²C	I3C
LPDDR4	

Lattice Propel Builder

AHB-L / AXI4

RISC-V   Memory   Interconnect

APB

GPIO   UART   Peripherals

Lattice Propel SDK Software Stack

Software Examples

BareMetal   FreeRTOS

BSP and Drivers

Toolchain and Standard C Libraries

Debugger   Compiler   Linker   Assembler   PicoLibc
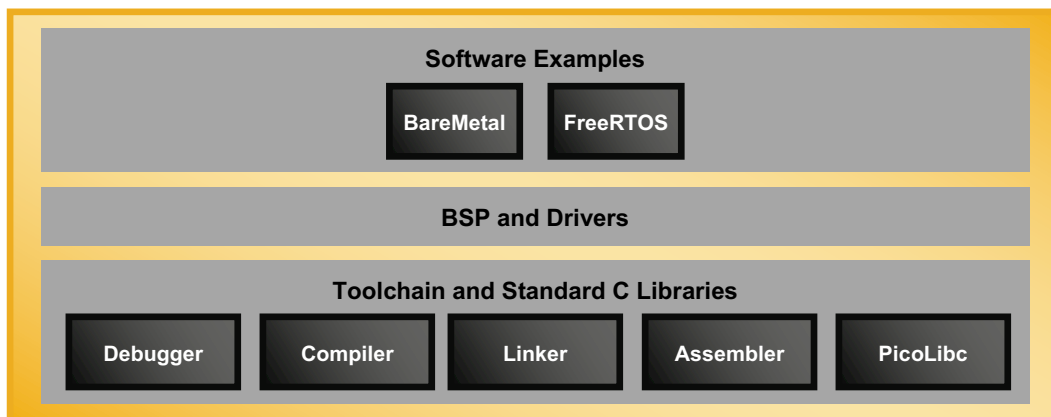
Note: FreeRTOS is only supported with RX CPU

Lattice Propel IP Cores

IP Name (Processors, Controls & Peripherals)	Mach-NX	MachXO2 / MachXO3	MachXO3D	CrossLink-NX	Certus-NX	CertusPro-NX	MachXO5-NX (Control)	CrossLink-NX-33
AXI4 to AHB-Lite Bridge	-	-	-	-	-	✓	✓	-
AXI4 to APB Bridge	-	-	-	-	-	✓	-	-
AXI4 Interconnect	-	-	-	-	-	✓	-	-
CNN Coprocessor Unit	-	-	-	✓	✓	✓	-	✓
Lattice Sentry PLD Interface for Mach-NX	✓	-	-	-	-	-	-	-
Lattice Sentry Embedded Security Block Mux	-	-	✓	-	-	-	-	-
Timer-Counter	-	-	-	✓	✓	-	-	✓
GPIO	-	-	✓	✓	✓	✓	✓	✓
Lattice Sentry I^{2}C Filter	✓	-	✓	-	-	-	-	-
I^{2}C Controller	-	-	-	✓	✓	✓	✓	✓
I^{2}C Target	-	-	-	✓	✓	✓	✓	✓
Lattice Sentry I^{2}C Monitor	-	-	✓	-	-	-	-	-
I3C Controller	-	-	-	✓	✓	✓	✓	✓
I3C Target	-	-	-	✓	✓	✓	✓	✓
Internal Flash Controller for MachXO5-NX	-	-	-	-	-	-	✓	-
Memory Controller	-	-	-	-	-	✓	-	-
Lattice Sentry QSPI Primary Streamer	-	-	✓	-	-	-	-	-
Lattice Sentry QSPI Monitor	-	-	✓	-	-	-	-	-
RISC-V MC	-	✓	✓	✓	✓	✓	✓	✓
RISC-V RX	-	-	-	-	-	✓	-	-
RISC-V SM	-	✓	✓	✓	✓	✓	✓	✓
SPI Flash Controller	-	-	-	✓	✓	✓	✓	✓
SPI Primary	-	-	-	✓	✓	✓	✓	✓
SPI Secondary	-	-	-	✓	✓	✓	✓	✓
UART 16550	-	-	-	✓	✓	✓	✓	✓
PCI Express Gen 1	-	-	-	✓	✓	-	-	-

IP Name (Connectivity)	Mach-NX	MachXO2 / MachXO3	MachXO3D	CrossLink-NX	Certus-NX	CertusPro-NX	MachXO5-NX (Control)	CrossLink-NX-33
SGMII and Gb Ethernet PCS	-	-	-	✓	✓	✓	✓	-
10 Gb Ethernet MAC	-	-	-	-	-	✓	-	-
Tri-Speed Ethernet MAC	-	-	-	✓	✓	✓	✓	-

Lattice Propel FPGA Design Tools

Design Tool	Key Features
Lattice Diamond	Optimized and tailored design and verification environment for Lattice FPGAs featuring fast iteration run times with comprehensive design constraints, advanced optimization, accurate analysis, and extensive verification.
Lattice Radiant	Full featured, easy to use Tool Suite, Lattice Radiant software offers all the best-in-class tools and features to help users develop their FPGA applications efficiently and effectively.

Lattice Propel Licensing Information

Design Tool	Licensing Terms
Lattice Propel	1-year free node-locked license available at www.latticesemi.com/licensing Features include access to both Diamond and Radiant

www.latticesemi.com