# Accelerate Tomorrow's Models with Lattice FPGAs

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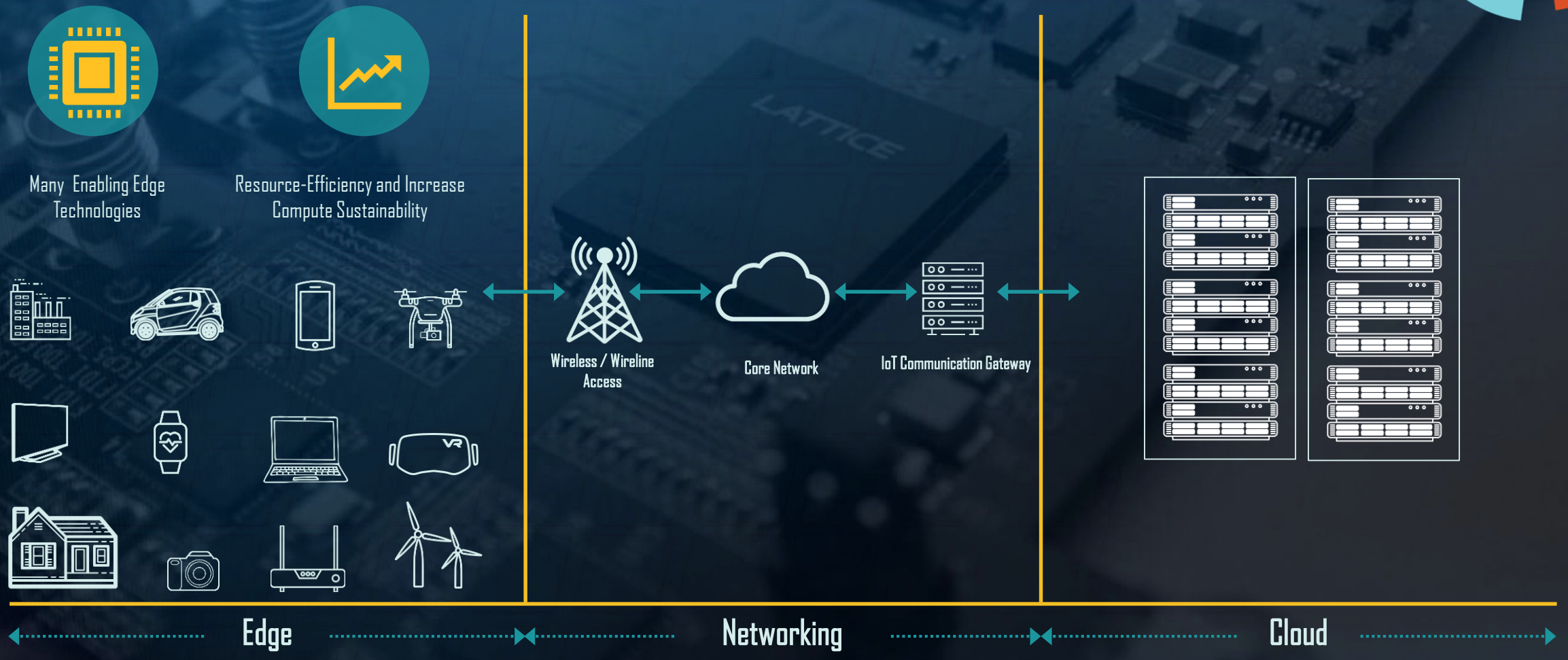
# Rapidly Emerging Edge Computing Trend

## Driven by Latency, Security, Privacy, and Bandwidth Limitations




On-device AI inference capability is expected to reach 60% of all devices by 2024 – ABI Research

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# Why FPGA for Edge AI

## Accelerating Innovation in low power applications

### Ultra-low Power

1 milliwatt to 1 W power consumption

### Scalable Performance To Handle Multiple Use Case

Executes multiple use cases in parallel or serial

### Secure

Secure device configuration

### Flexible Computation Resources

Pre and post processing of data such as ISP, FFT and filtering

### Hardware Programmable

Adapts to fast changing machine learning algorithms

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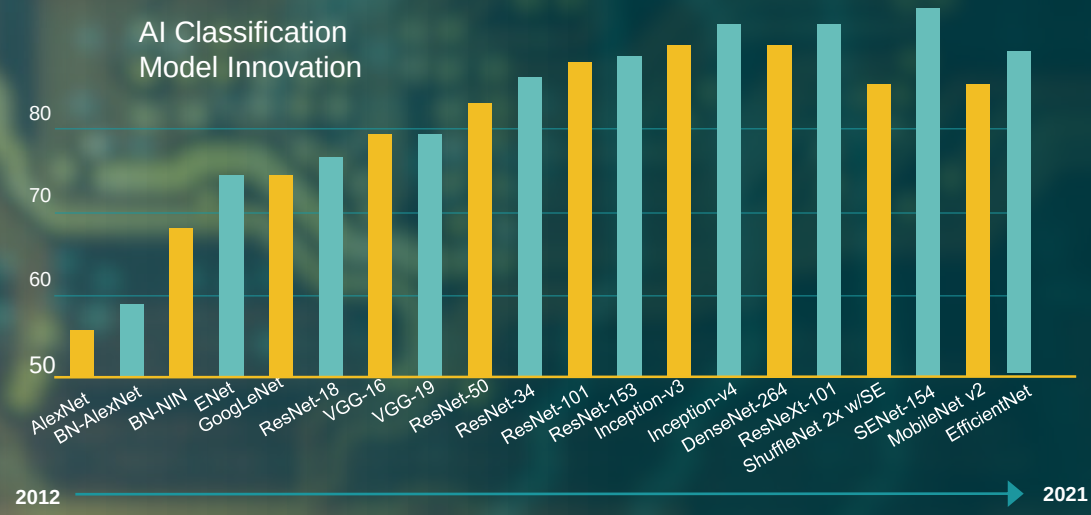
# The Speed of AI Innovation Benefits Programmable Logic to Keep Delivering the Best Experience

Hardware Optimization & Algorithm Optimization = Continuous Improvement and New Use Cases

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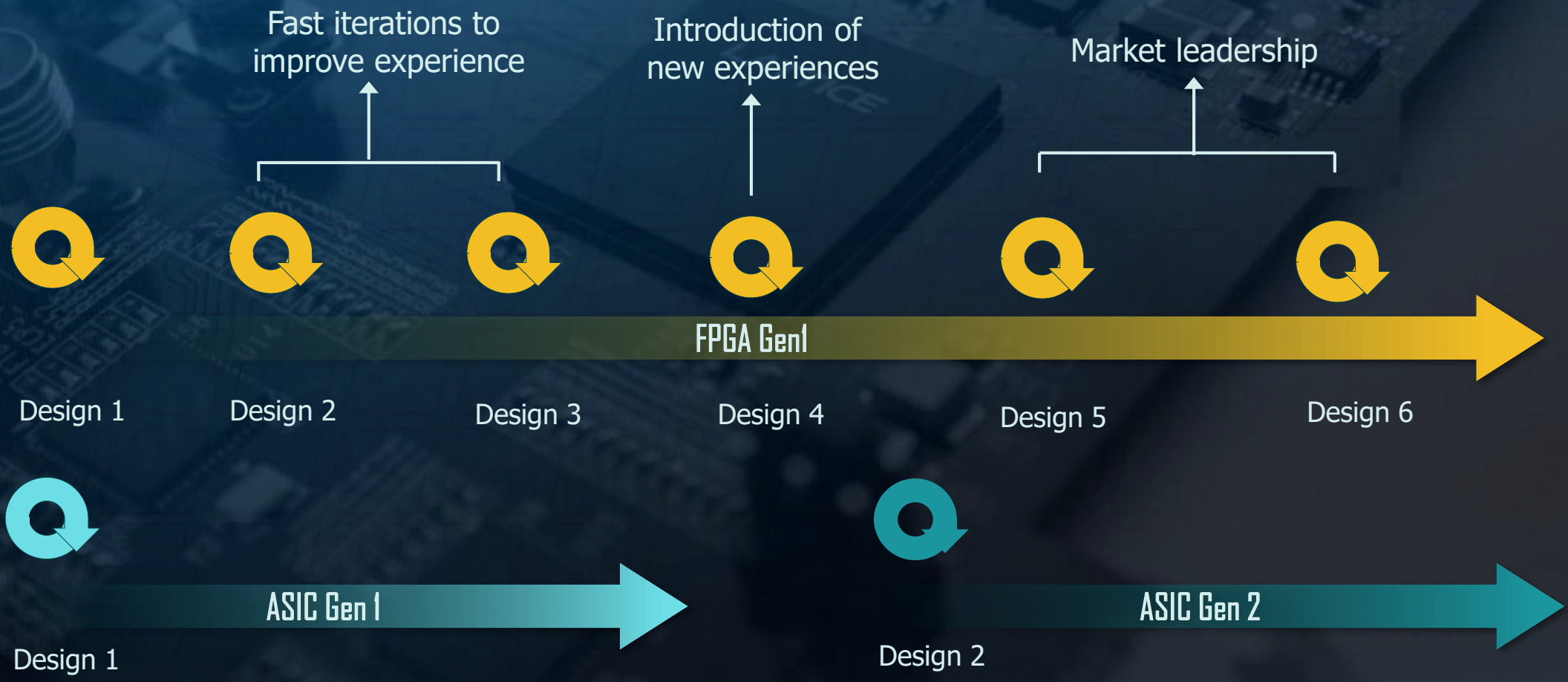
# AI Models Rapidly Evolve Requiring an Agile Development that ASIC Solutions Cannot Match

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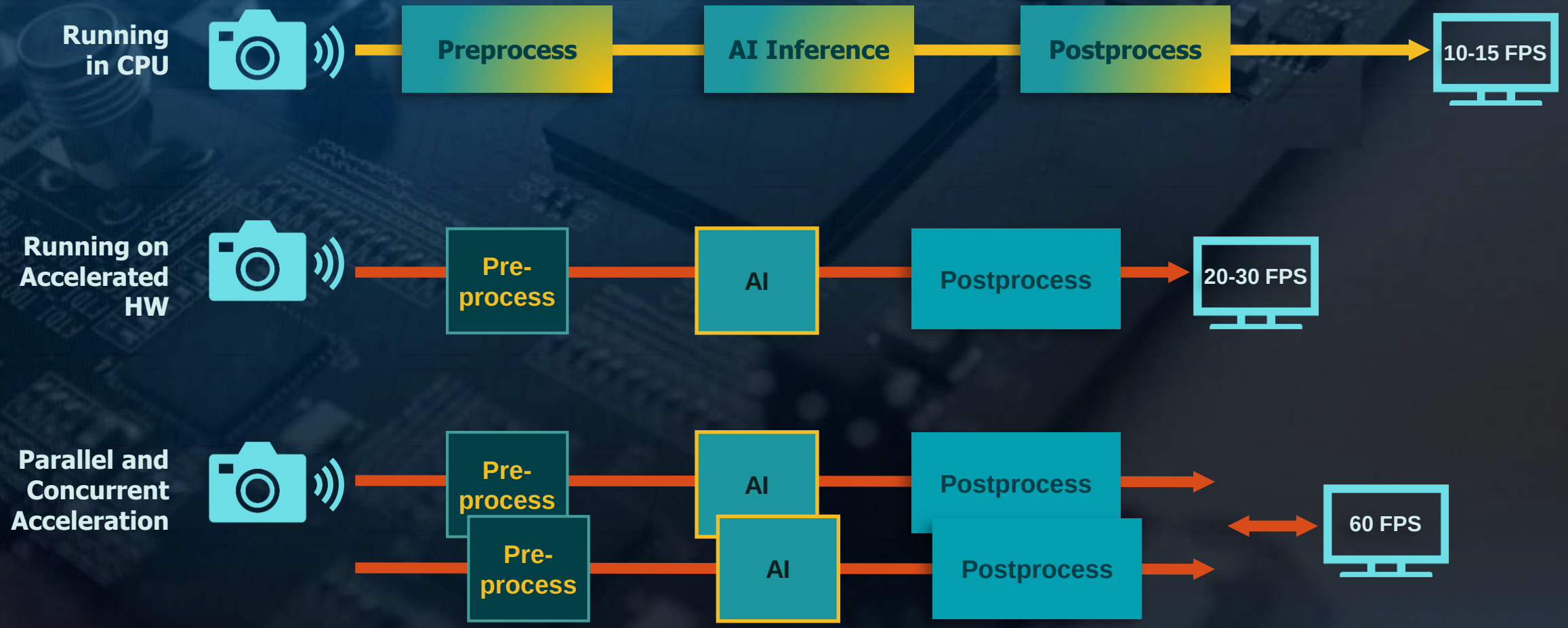
# Parallel and Concurrent Acceleration

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# LATTICE sensAI™

## CUSTOM DESIGN SERVICES

Smart Home | Smart City | Smart Factory | Smart Car | Client Compute Experiences

## REFERENCE DESIGNS / DEMOS

Hand Gesture Detection | Key Phrase Detection | Human Presence Detection | Human Attention Tracking | Object Counting | Object Classification

## SOFTWARE TOOLS

sensAI Studio | Neural Network Compiler

LATTICE RADIANT DESIGN SOFTWARE | LATTICE PROPEL™ | Caffe | TensorFlow | TensorFlow Lite | Keras | LATTICE DIAMOND DESIGN SOFTWARE

## IP CORES

CNN Compact Accelerator | Neural Network Accelerators | CNN Accelerator | CNN Plus Accelerator | CNN Co-Processor Accelerator

## HARDWARE PLATFORMS

Upduino | CrossLink™-NX Voice and Vision ML Board | CertusPro™-NX Voice and Vision ML Board | ECP5™ EVDK

Ultra Low Power

Small Form Factor

Customizable

iCE40™ UltraPlus
1-20 mW, 5.5 mm²

CrossLink™-NX
50-200 mW, 16 mm²

CertusPro™-NX
400 mW, 81 mm²

ECP5™
250 - 850 mW, 100 mm2

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# 2x Performance at Half the Power

## Lattice CertusPro-NX

### Advanced General Purpose FPGA

- CLASS-LEADING POWER EFFICIENCY
- BEST-IN-CLASS SYSTEM BANDWIDTH
- OPTIMIZED EDGE PROCESSING
- INDUSTRY-LEADING RELIABILITY
- SMALLEST FORM FACTOR

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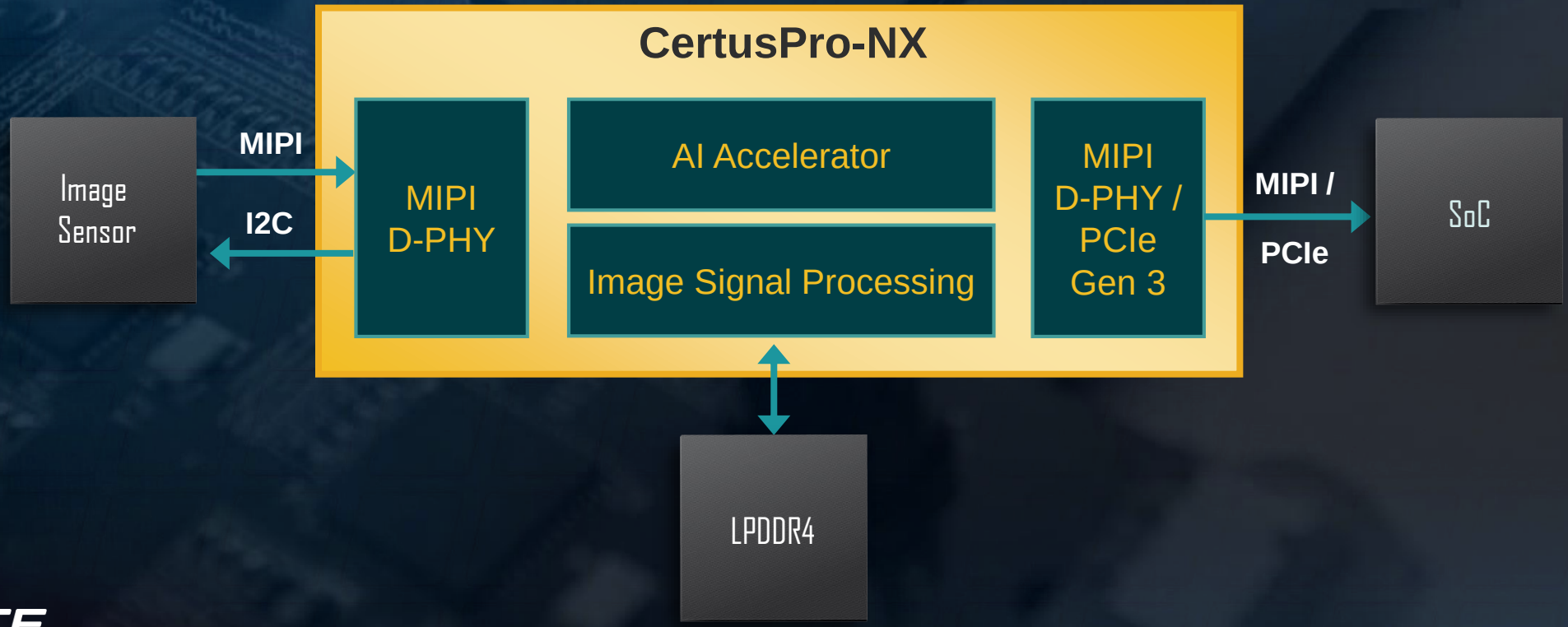
# CertusPro-NX Application Example

## Smart Camera AI Processing

- Offload AI processing and ISP from SoC
- Interface with popular image sensors over MIPI at up to 1.5 Gbps per lane, using High Performance IO (HPIO)
- Up to 7.3 Mb on-chip memory and flexible DSP resources to efficiently perform AI processing and ISP
- LPDDR4 external memory support for frame buffering
- Flexible output over MIPI or PCIe to SoC to enable smart devices with high quality imaging

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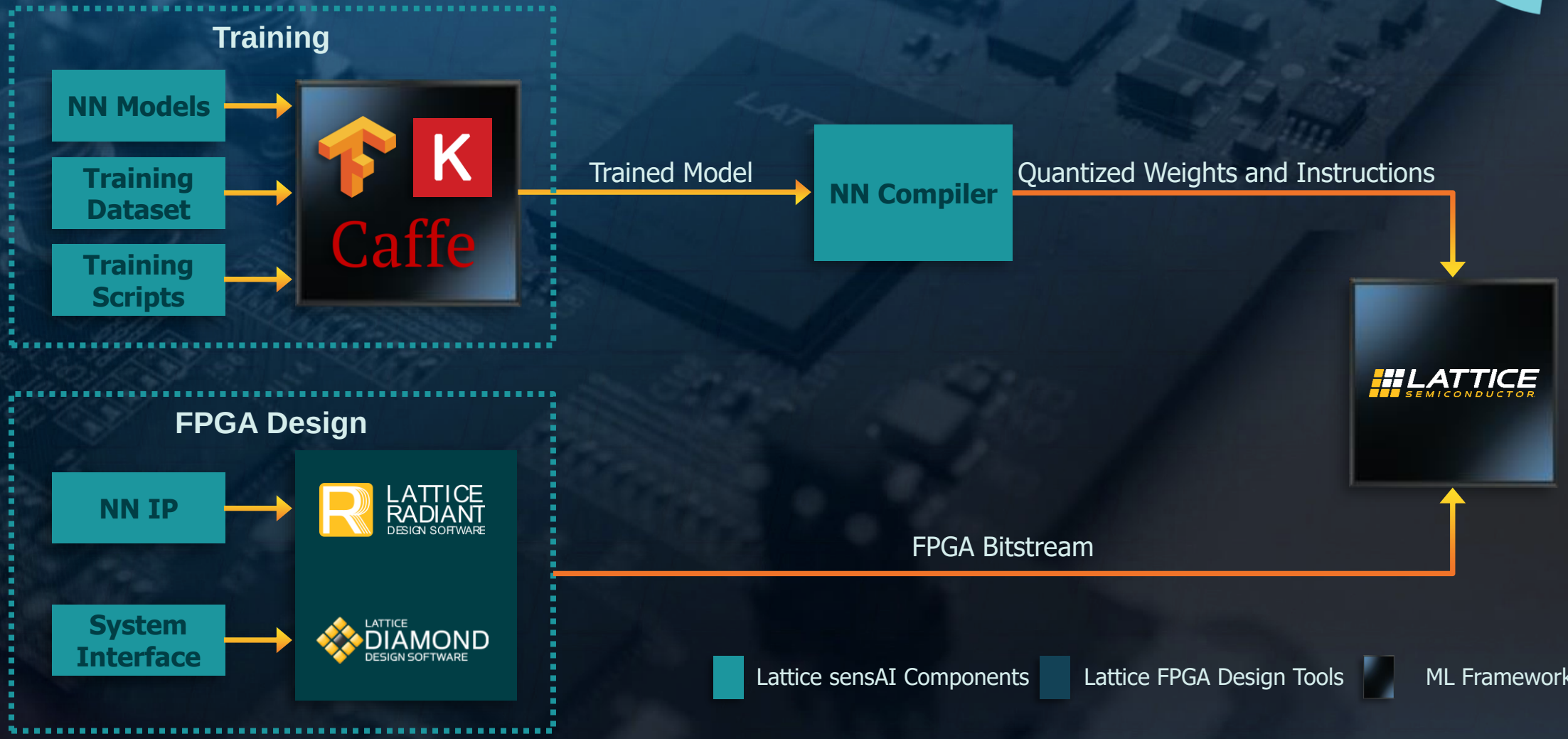
# Hardware Optimized Design Methodology





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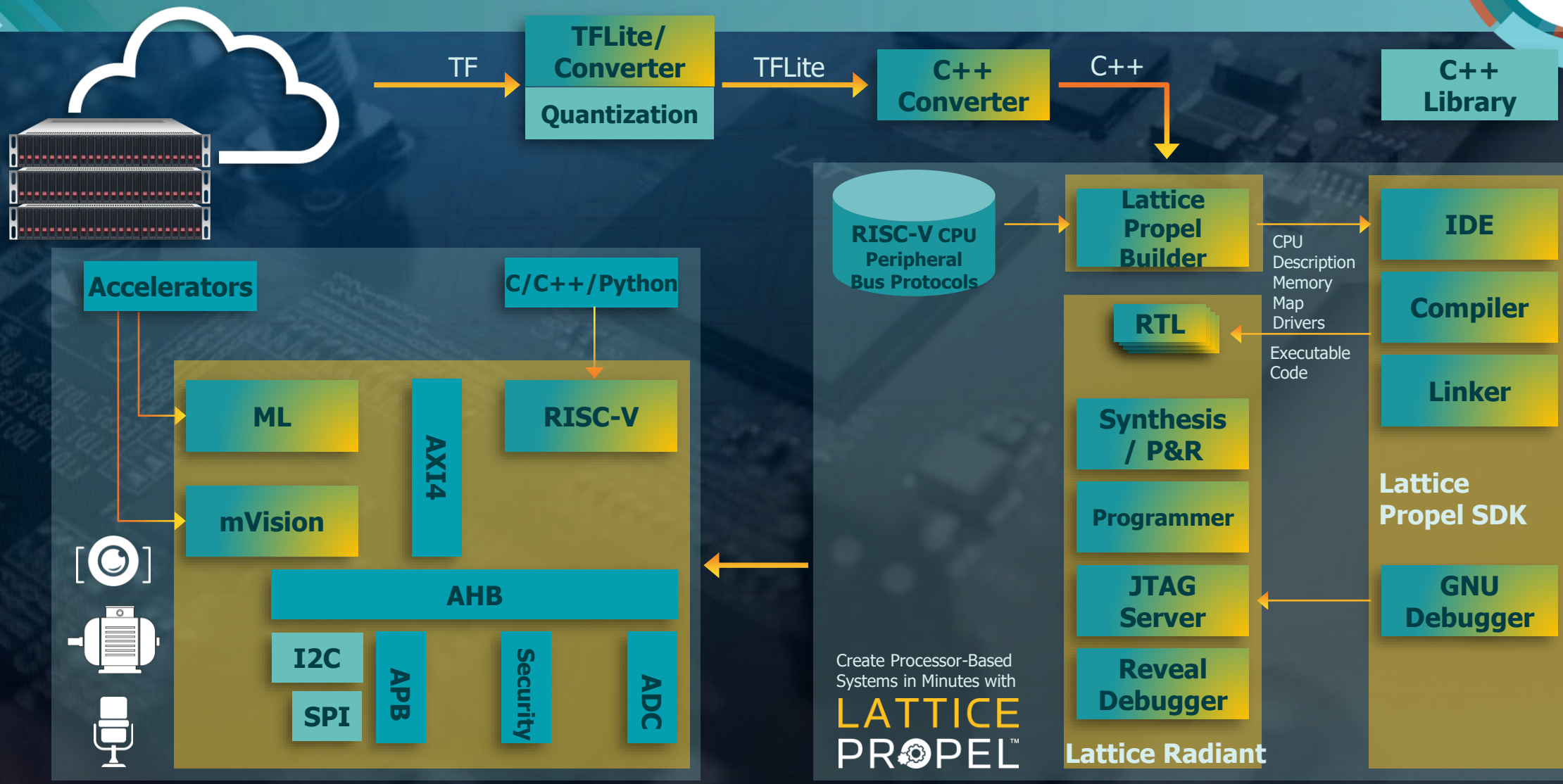
# Software Optimized Design Methodology

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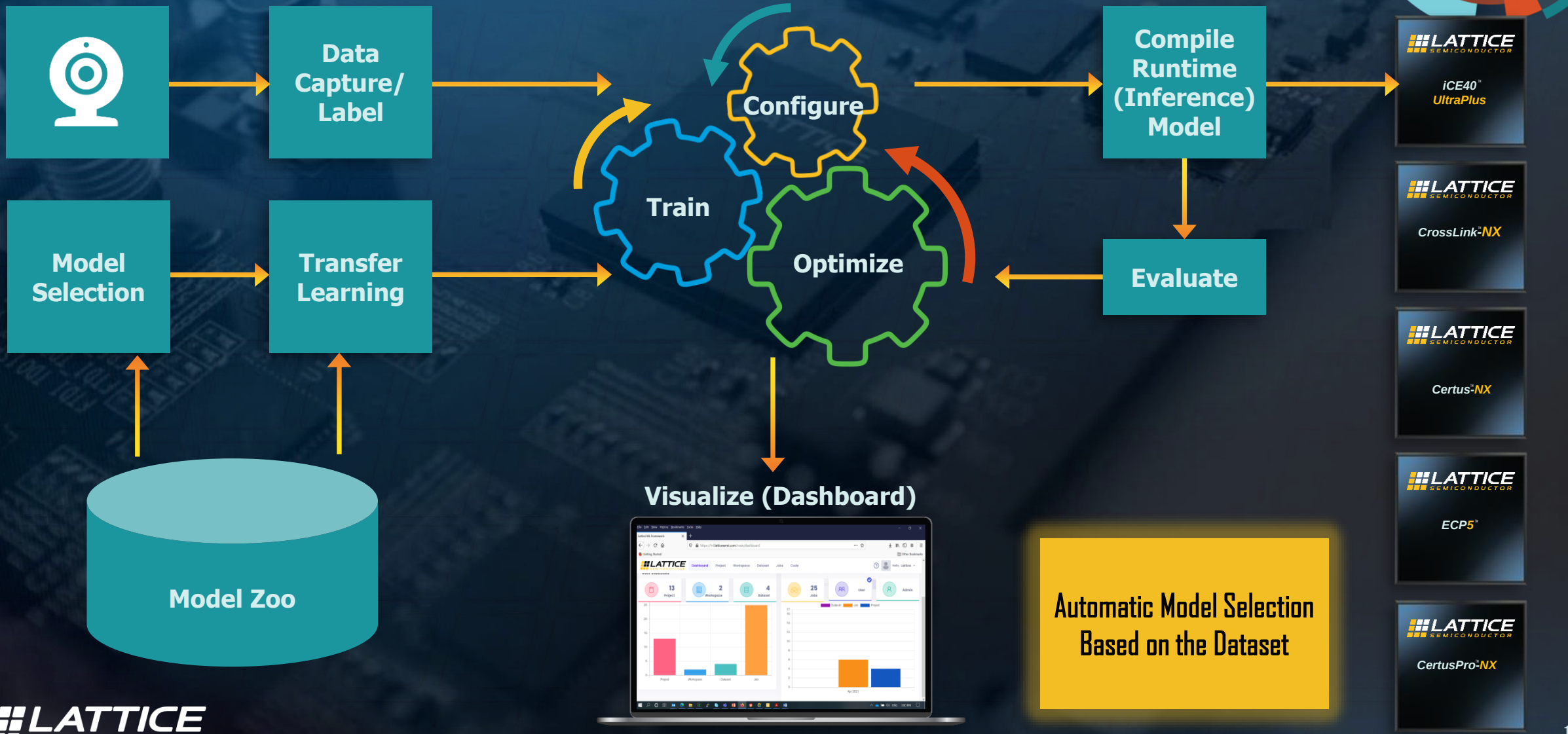
# Lattice sensAI Studio




Automatic Model Selection Based on the Dataset

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# Object Classification – Multiple Objects Tracking at Low Power

| FEATURES | |
|---|---|
| Sensor | CMOS image sensor (IMX258) |
| Speed | 33 frames per second |
| Power | 400 mW on CertusPro-NX |
| Resolution | 224 x 224 x 3 |

## BARCODE DETECTION

## DEFECT DETECTION

## ROBOT NAVIGATION

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# Lattice sensAI Enables Next Generation Smart PC Experiences

# PC Usage Dominates the Daytime Productive Hours

% of each platform's average daily impressions by hour

**Late Night**
12am – 7am

**Early Morning**
7am – 10am

**Daytime**
10am – 5pm

**Early Evening**
5pm – 8pm

**Prime**
8pm – 12am

Source: https://www.smartinsights.com/mobile-marketing/mobile-marketing-analytics/mobile-marketing-statistics/

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# Next Generation PC Trends

- Smart and Aware
- Great Collaboration
- Slim and New Form-Factors

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# Lattice sensAI - Smart and Aware AI Solutions

## User Presence Detection

Instant On and Aware

## Attention Tracking

Delivers up to 28% Additional Battery Life

## Onlooker Detection

Guards the User Private Data

## Face Framing

Collaborative Conference Experience

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