HOW FAR CAN YOU GO WITH NXP'S FLEXIBLE LAYERSCAPE PORTFOLIO?

ALTAF HUSSAIN
MARKETING MANAGER

AMF-NET-T2677 | JUNE 2017

SECURE CONNECTIONS FOR A SMARTER WORLD

AGENDA

Digital Networking

- Target Segments
- Solutions Approach
- Roadmap

Gateway/Router Solutions

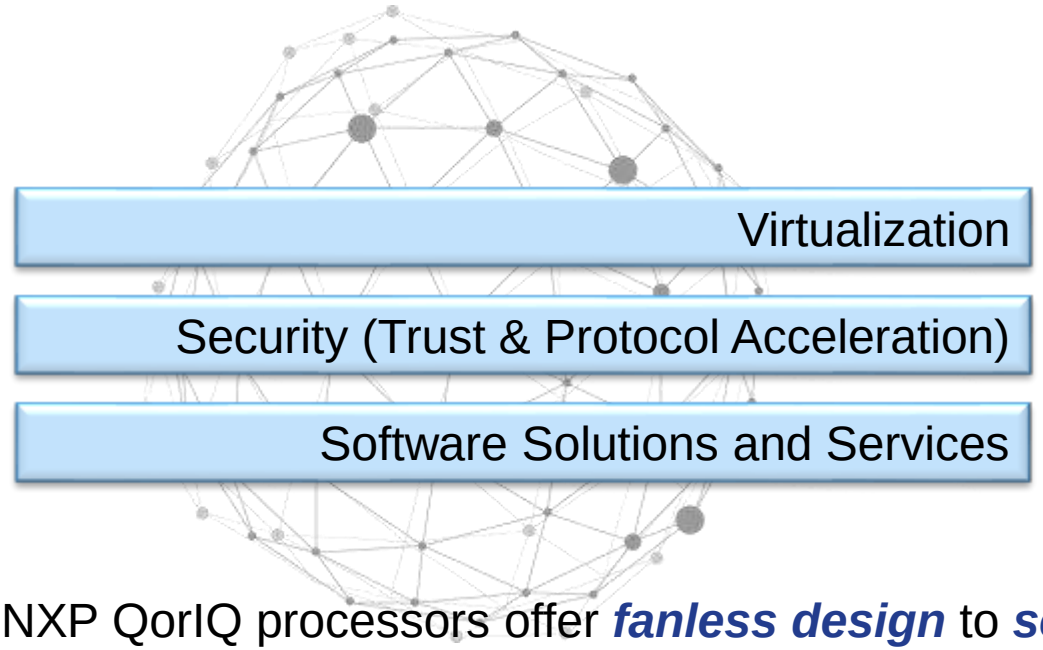
- SMB Routers
- Broadband Gateways
- Smart Home and IoT Gateways

Industrial Applications

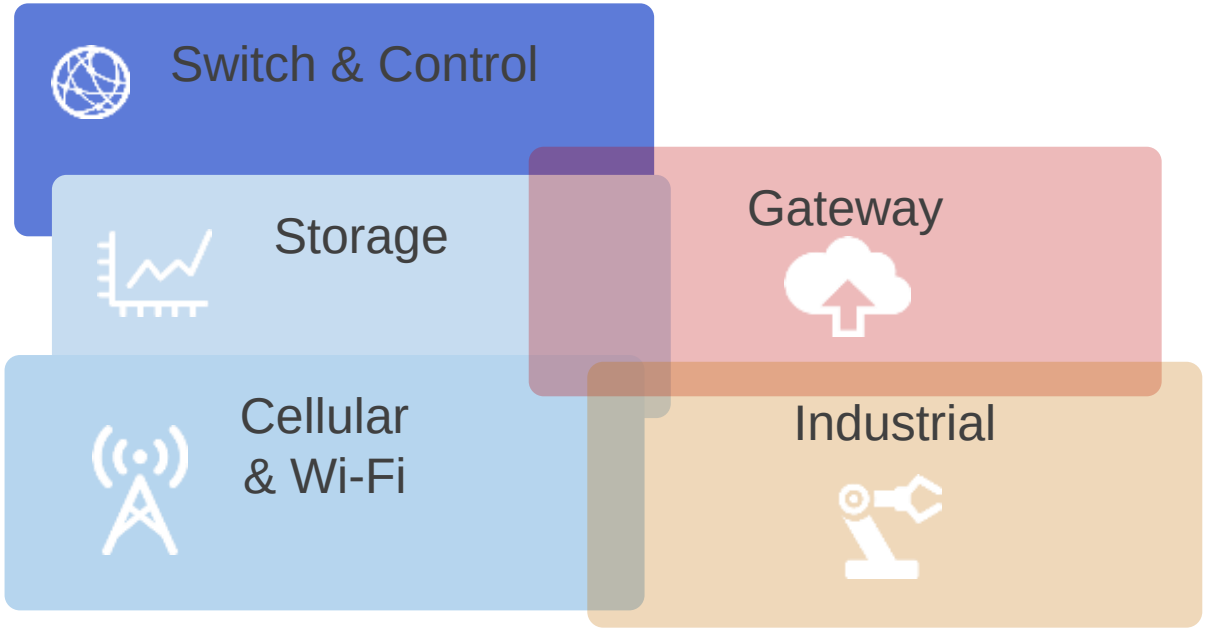
Wireless Solutions

Who is Digital Networking…

Enabling Secure Infrastructure
with Cost- & Power-Efficient Solutions
and unique expertise



Layerscape Targeted Solution Segments



NXP QorIQ processors offer ***fanless design*** to ***server class performance*** for real time control and high touch data services in a wide range of embedded applications

Building Systems Expertise for Best in Industry Solutions Portfolio

Silicon and Software Provide the Solutions our Customer Require

Multicore Processors

- 35W LS2088
- LS2080
- LS1088
- LS1046
- LS1043
- LS1021
- 1W LS1012

Smart Home

IOT Gateway

High-End GW

Retail Router

Services Routers

Carrier WAP

Enterprise WAP

Wi-Fi Extender

vE-CPE

vCPE

SD-WAN Access Node

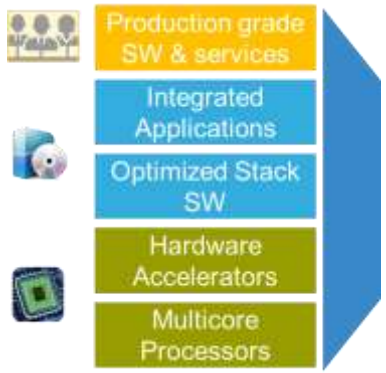
100Gbps Services Switch

25Gbps Services Switch

NFV infrastructure

Roadside Infrastructure

Solutions deployed by ODM and OEM partners



Software Platforms

IOT & Home | GW | WLAN | vCPE | Switch | NFV | ITS

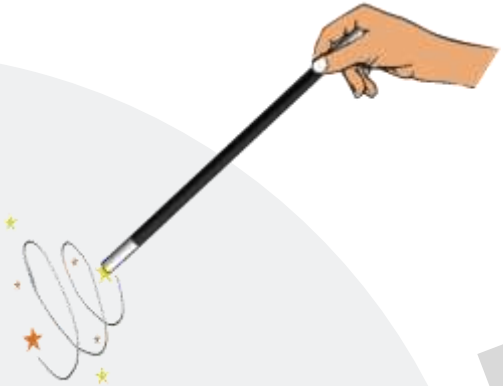
Enablement Software

Secure Embedded & Enterprise Linux Distributions

Solution Definition

Switch & Control Systems

Home and Office
Wired and Wireless Systems



Production grade SW & services

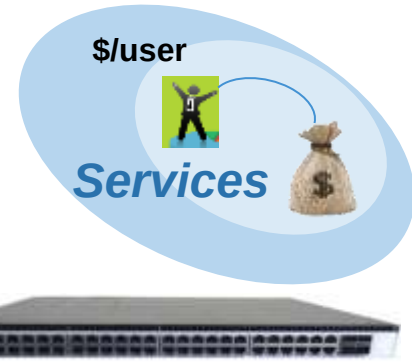
Integrated Applications

Optimized Stack SW

Hardware Accelerators

Multicore Processors

Industrial Systems



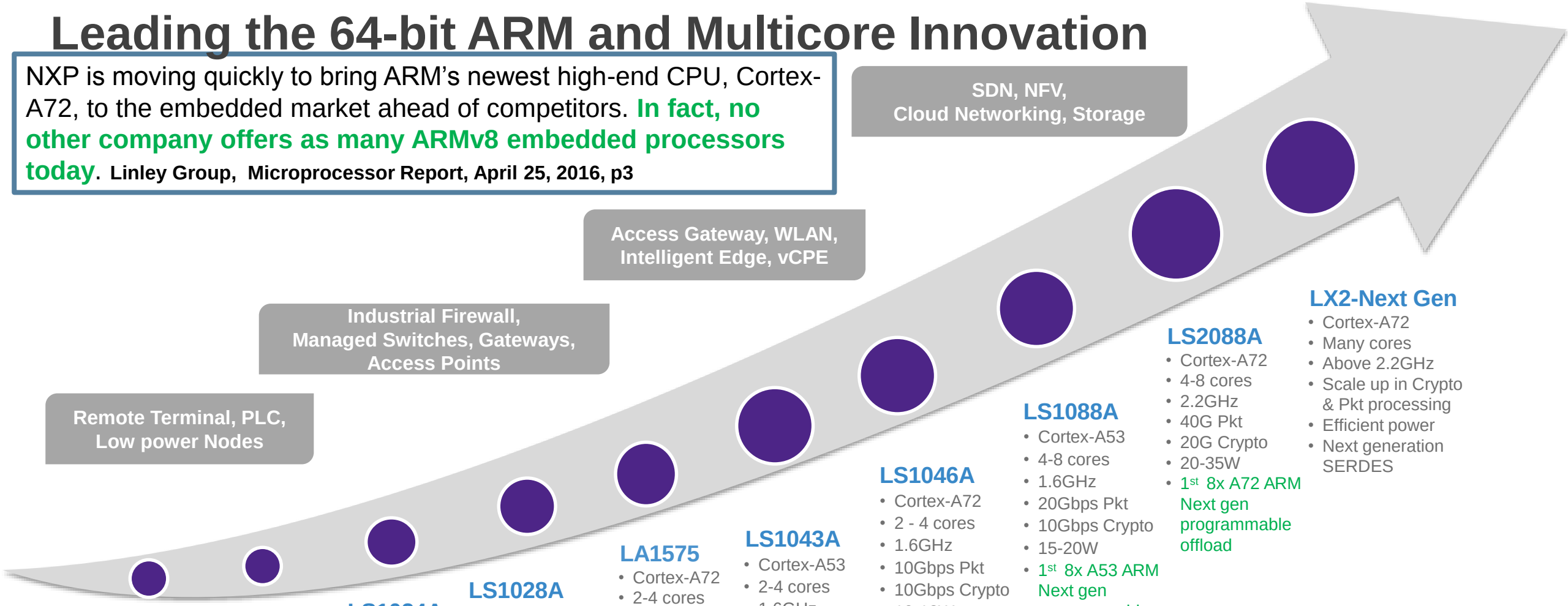
Datacenter systems

Virtualization

Security (Trust & Protocol Acceleration)

Leading the 64-bit ARM and Multicore Innovation

NXP is moving quickly to bring ARM's newest high-end CPU, Cortex-A72, to the embedded market ahead of competitors. **In fact, no other company offers as many ARMv8 embedded processors today.** **Linley Group, Microprocessor Report, April 25, 2016, p3**



LS1012A
- Cortex-A53
- 1GHz
- 2Gbps Packet
- 1Gbps Crypto
- 1-2W
- Lowest power 64-bit ARM

LS1021A
- Cortex-A7
- 2 cores
- 1GHz
- 2Gbps Pkt
- 1Gbps Crypto
- 2W

LS1024A
- Cortex-A9
- 2 cores
- 1.2GHz
- 2Gbps Pkt
- 2Gbps Crypto
- 3-5W

LS1028A
- *Cortex-A72*
- *2 cores*
- *1,6GHz*
- *5Gbps Pkt*
- *5Gbps Crypto*
- 4-9W
- *1st with TSN switch*
- *Integrated GPU*

LA1575
- Cortex-A72
- 2-4 cores
- 10+Gbps Pkt
- 4-9W
- Multi-protocol
- Programmable PHY

LS1043A
- Cortex-A53
- 2-4 cores
- 1.6GHz
- 10Gbps Pkt
- 5Gbps Crypto
- 5-10W
- 1st 64-bit ARM processor for gateways and access points

LS1046A
- Cortex-A72
- 2 - 4 cores
- 1.6GHz
- 10Gbps Pkt
- 10Gbps Crypto
- 10-12W
- 1st Value Tier A72 ARM for gateways and routers

LS1088A
- Cortex-A53
- 4-8 cores
- 1.6GHz
- 20Gbps Pkt
- 10Gbps Crypto
- 15-20W
- 1st 8x A53 ARM Next gen programmable offload

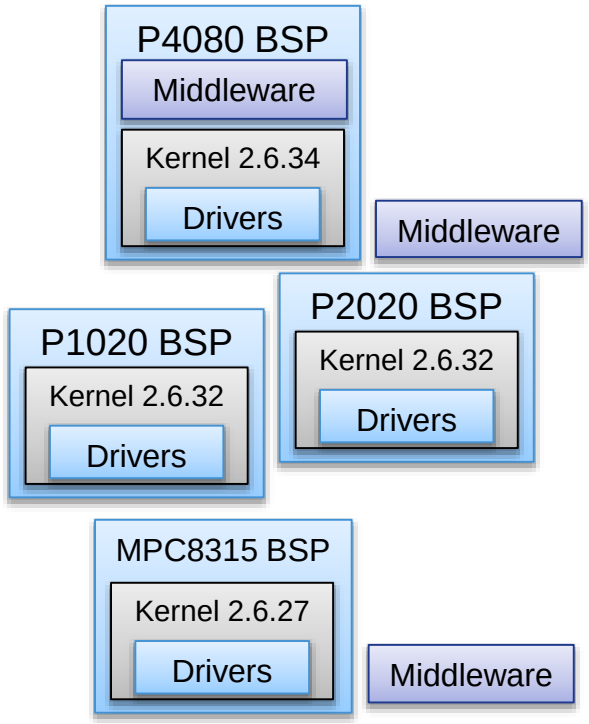
LS2088A
- Cortex-A72
- 4-8 cores
- 2.2GHz
- 40G Pkt
- 20G Crypto
- 20-35W
- 1st 8x A72 ARM Next gen programmable offload

LX2-Next Gen
- Cortex-A72
- Many cores
- Above 2.2GHz
- Scale up in Crypto & Pkt processing
- Efficient power
- Next generation SERDES

Linux for Layerscape - Evolution

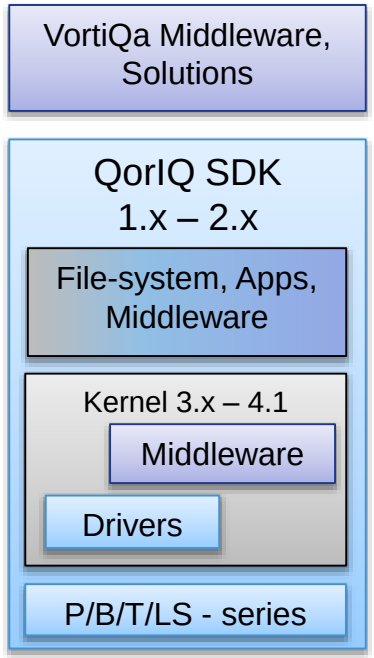
BSP Era: pre-2010

- **NPI** Focus
- Fragmented releases
- Duplication of drivers, middleware



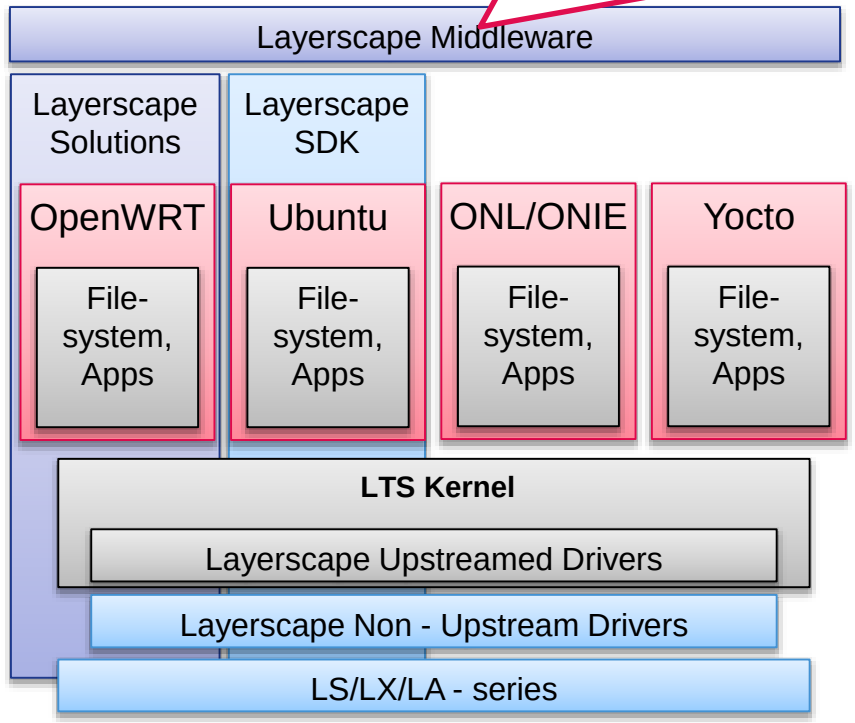
Yocto SDK Era: 2011 - 2016

- **Platform** Focus
- Unified release, common kernel
- Regular release cadence, testing
- Proprietary Distro-like package
- Middleware pollution
- Limited upstream effort

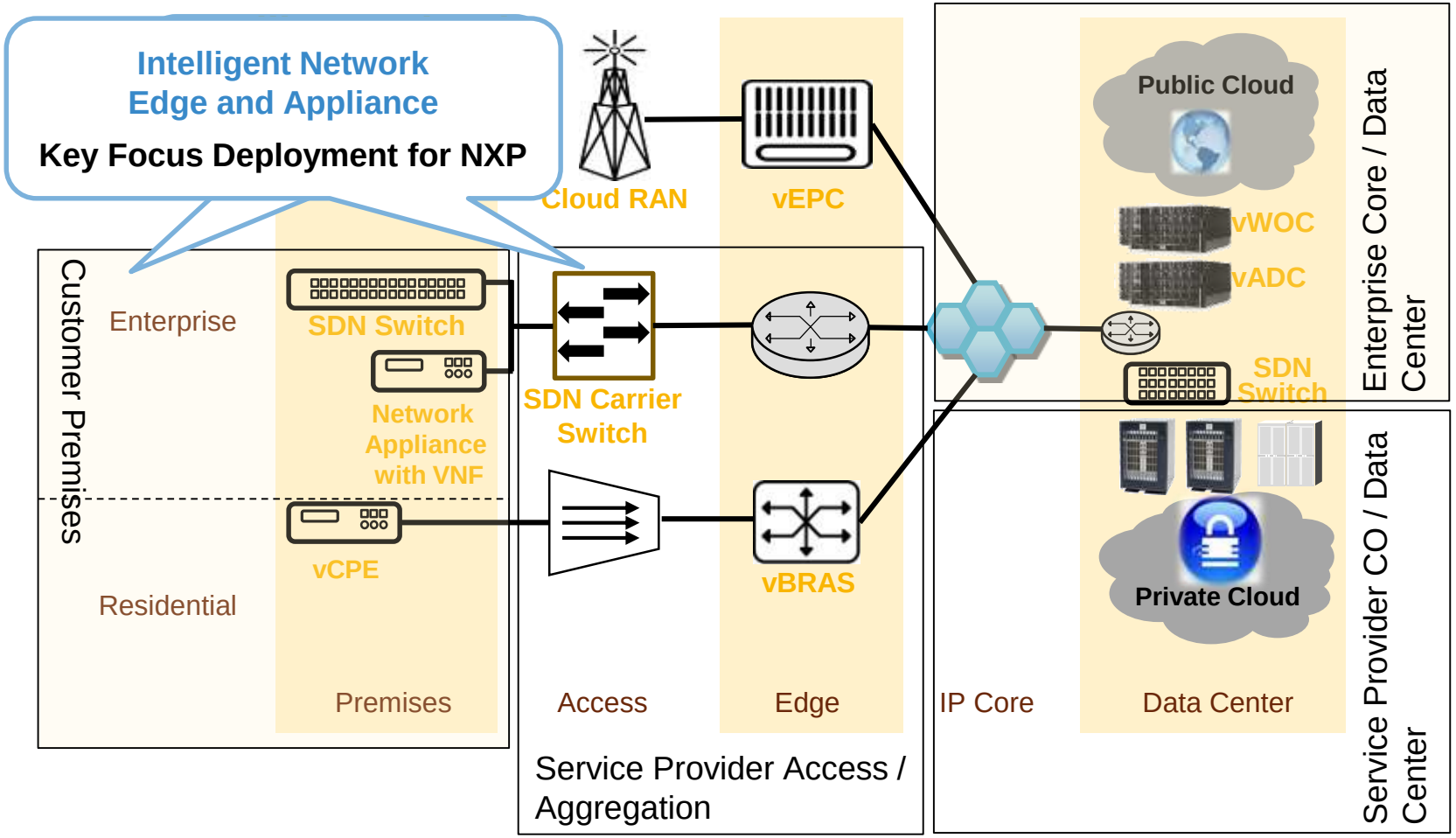


Distro Era: 2017 -

- **Customer, Community** Focus
- Strong upstream effort
- Layered kernel, user-space components
- Separated middleware and solutions
- Support for multiple community distros
- Strong participation in community efforts



Drive Networking Solutions and the New Network



NXP Value Proposition

- **Scalability**
  - Intelligent Cloud Edge to Network Appliance
  - Scale from 1W to 100 Gbps of services
- **Best Performance / Watt**
  - Hardware Assisted Network IO virtualization
  - Leadership in ARM Virtualization support
- **Standards Compliant Solution**
  - Standard virtualization components
  - Seamlessly plug in acceleration
  - Standard OS, install environment

Virtualization Will Be Used Throughout the Network

NXP Optimized NFV Solution offering

Standard Hardware Platforms	• ARMv8: LS1043, LS1046, LS1048, LS1088, LS2088
Standard Linux Distro	• CentOS (planned), UEFI, Ubuntu* (hybrid mode)
Standard Virtualization components	• KVM, QEMU, Docker, Ceph (planned)
Standard Orchestration and Management	• OP-NFV: OpenDaylight, OpenStack, Open Contrail
Standard API and libraries	• DPDK, ODP, OVS, Virtio
Reference Virtual Network Functions	• vFirewall, vNAT, vRouter, vVPN
Out-of-the-Box Experience	• Benchmarks, User-guide, Documentation

Comprehensive Solution: Hardware, Software, Ecosystem

Deployments for the Service Provider and Enterprise Segments

Wireless

- Shipping to leading global players
- Scalability for Low, Mid, High-End Solutions
- Complete protocol offload for IPSec, GRE, DTLS, CAPWAP
- Complete SW solution with OpenWRT support
- Macro-basestation, Small Cell, Layer-1 & Transport

Services Routers, Network Appliance

- Scalable portfolio of SoCs with common SW
- Complete software stack with offload support
- Offload provides compelling performance in a smaller power envelope: ***10G and 20G fanless design options***
- Protocol aware offload with ***25% performance advantage*** over crypto only architecture: e.g. x86, Cavium
- Strong ODM support

Evolved Control Plane and Switching

- Increasing adoption of services as differentiators
- DNG offers strong portfolio of SoC + SW solutions
- Enabling new services like network visualization for OEM customers
- Leverage our installed base with leading global OEMs

Virtualized Networks

- Leadership in virtualization technology (HW and SW) and acceleration assist for virtualization
- Strong performance analysis to demonstrate virtualization performance
- Driving industry standardized approach for ease of adoption

openstack · OPNFV · OPENCONTRAIL

01.

Gateway / Routers

Enterprise and SMB Router

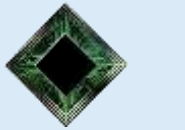
Broadband Gateway

IoT Gateway

Market Leadership in SMB and Enterprise Multiservice Routers

1980's

MC68302



1990's

MC683xx
PQ1
PQ2

2000's

PQ3
QorIQ P-series

2010's

QorIQ P-series
QorIQ T-series
Layerscape

NXP Driving Multiple Generations of Routers over three decades

CISCO

H3C

ADTRAN

ONEACCESS NETWORKS

NEC

YAMAHA

NXP communications processors are in over 80% of SMB Routers currently in the market

Note: includes Motorola SPS & Freescale products

Router Domain Knowledge + Software Track Record

	Customers	Example Equipment	SW	Ecosystem
SMB		 	NXP ASK *Application Solution Kit* SDK + OEM SW	
Enterprise			SDK + OEM SW	
Broadband Gateway			NXP ASK *Application Solution Kit* SDK + OEM SW	

NXP: The Only Solution Provider for Small Business Router

NXP team support on SMB Router software functions, interop etc.

System (Product) Final Integration, Validation & Testing

GUI, CLI & management interfaces

Additional functions and 3rd party functions inclusions – Anti-Virus, Web security, IPS, Wireless, Application Control etc.

NXP Small Business Router SDK (SMB Router) with enhancements

(LAN, WAN, NAT, Routing, Firewall, VPN, QoS, IPv6, Network Management, others)

Linux OS: customization of BSP/LSP & drivers for switch etc.

Bootloader s/w: Potential customization on top of default bootloader -memory address space, I/O access

Customer Platform: NXP Multicore processor, 3rd party switch, WiFi etc.& electrical & environmental certification for h/w

Product Launch activities – End user documentation, training & support

Responsibility sharing scenario

NXP | ODM partner | Customer

LS1043A **LS1046A** **LS1088A**

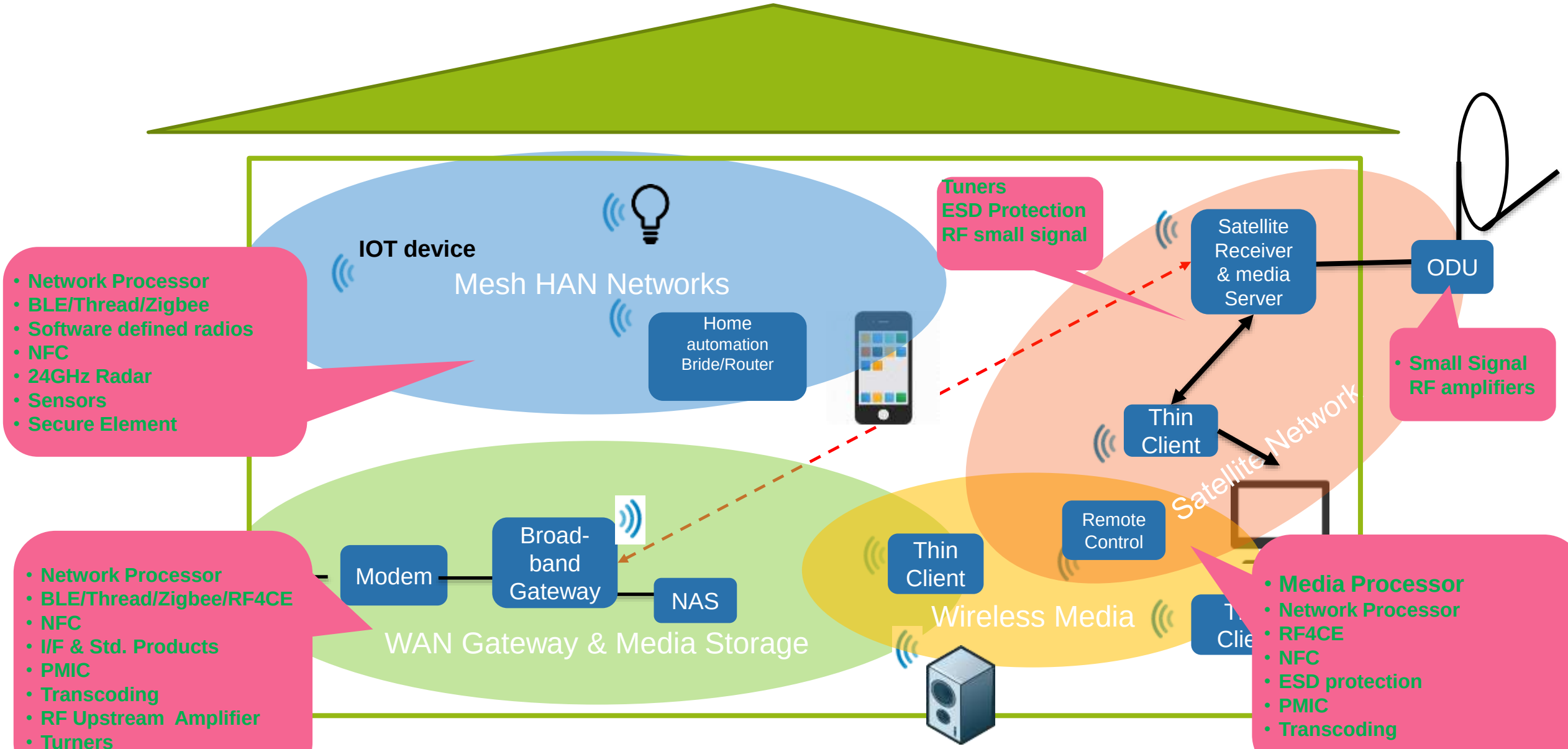
Pin compatible solutions

LS1024A

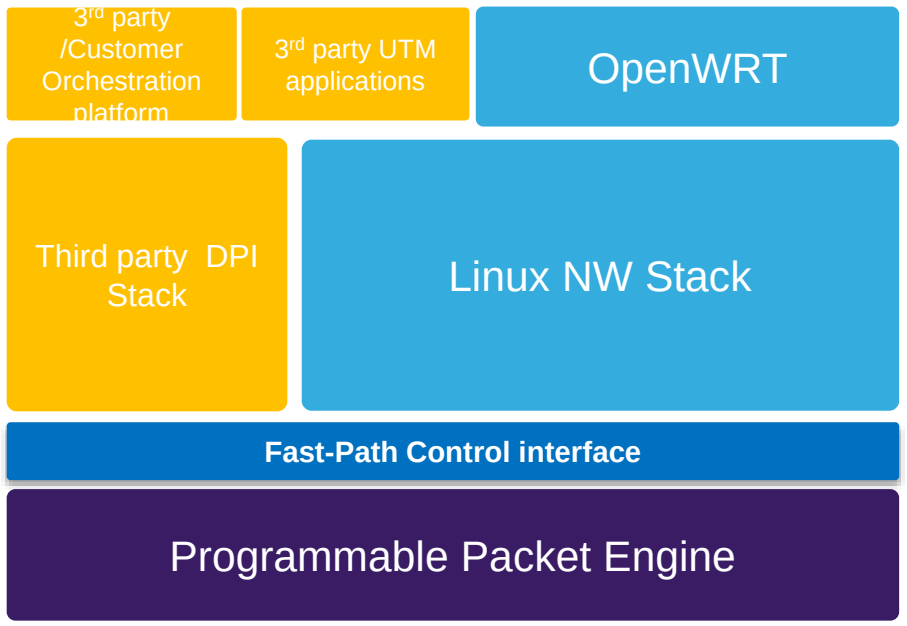
LS1012A

Potential focus of our next steps

NXP Solutions for the broadband connected home

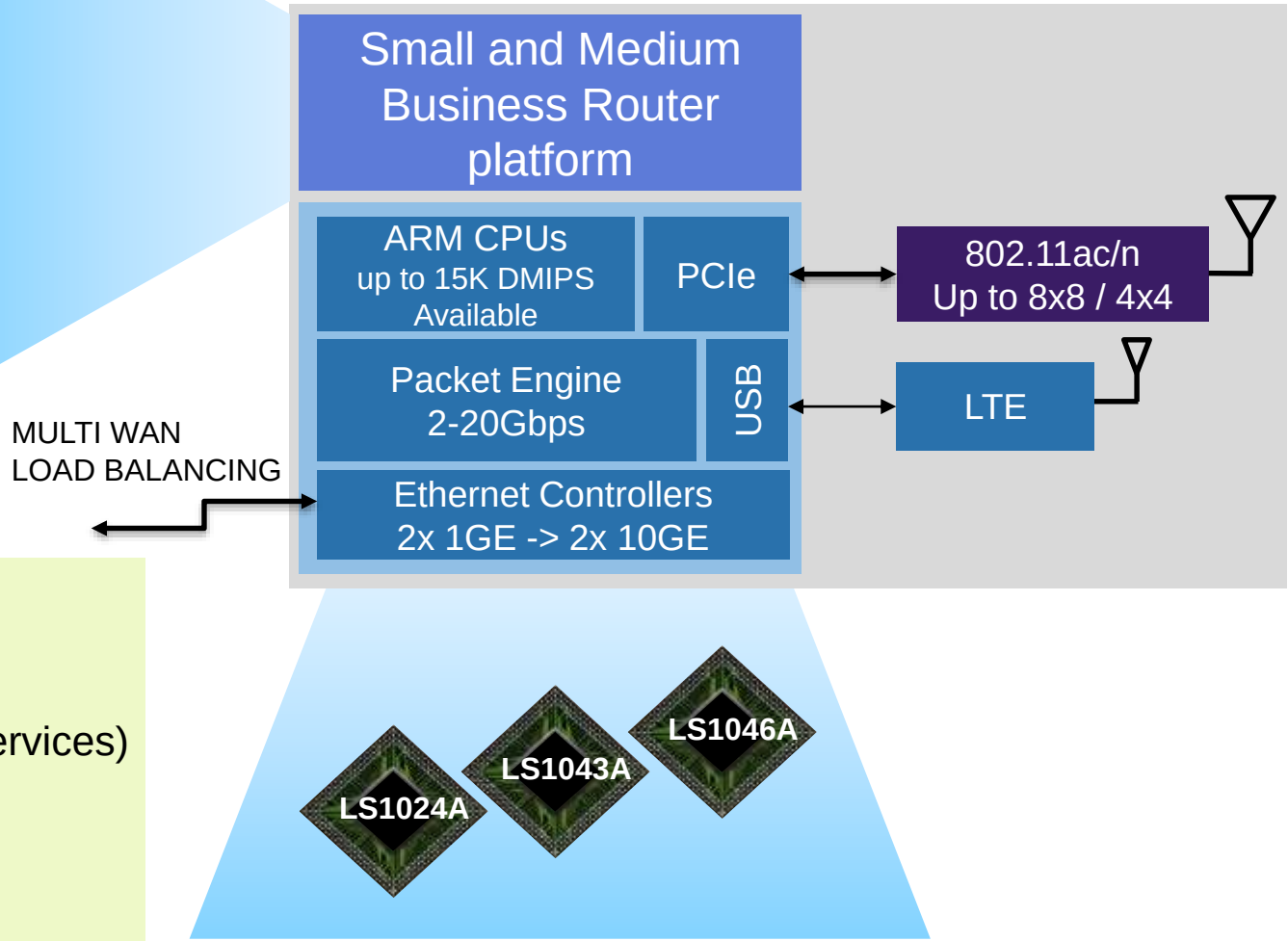


Scalable Small & Medium Business Routers



Production Grade Software

Scalable Hardware



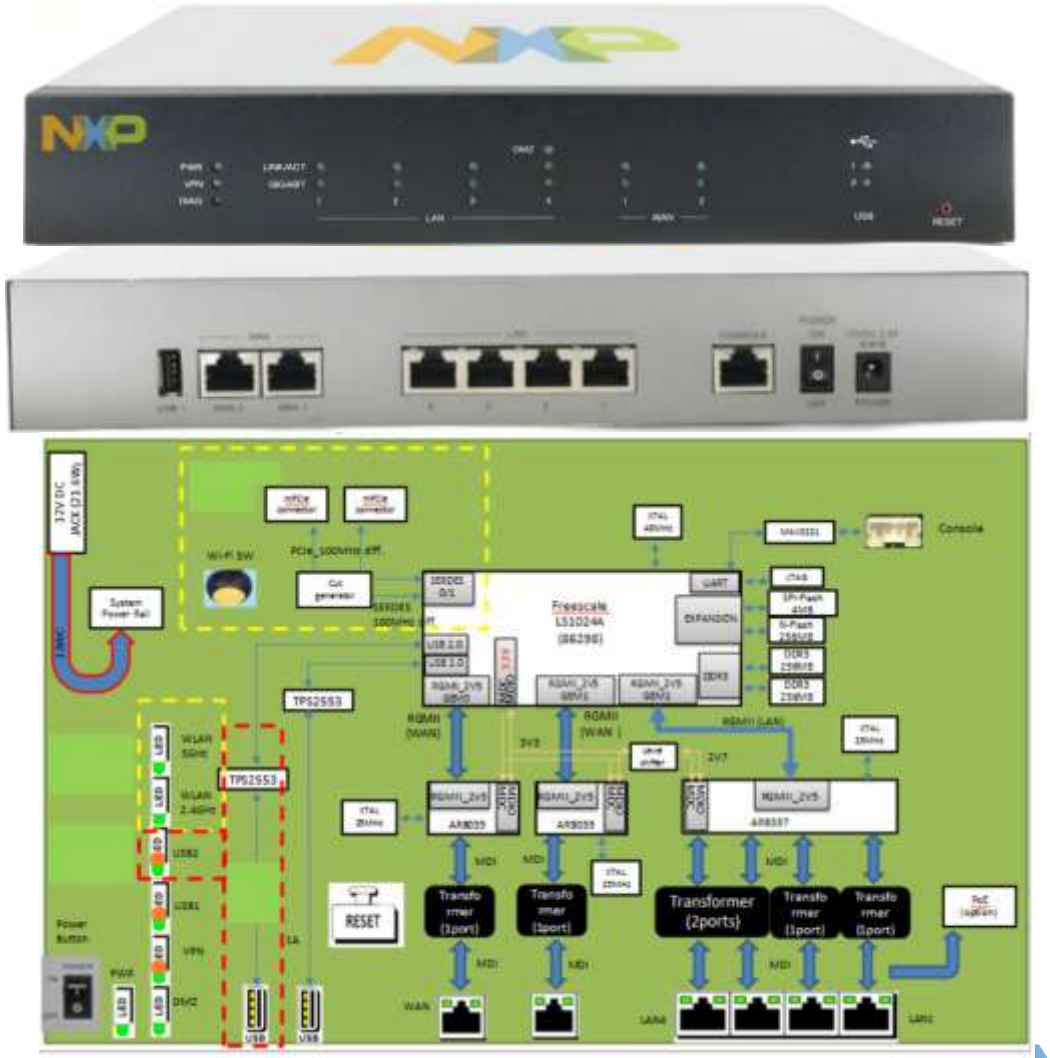
NXP Enables:

- Programmability and scalable performance
- Power and performance for wide range of SKUs
- Convection cooled / fanless design (sub-10W 10G services)
- Packet processing, Security, DPI, QoS performance
- OpenWRT community support
- Upstreamed software (drivers, accelerators/offload)
- Longevity, extended temperature

LS1024 Dual WAN VPN Router Solution

Keep your small business safe from online threats. This router with web filtering protects your network by blocking unwanted and low-reputation websites. This model is ideal for growing small businesses and offices that require a performance networking router with ultra-reliable uptime.

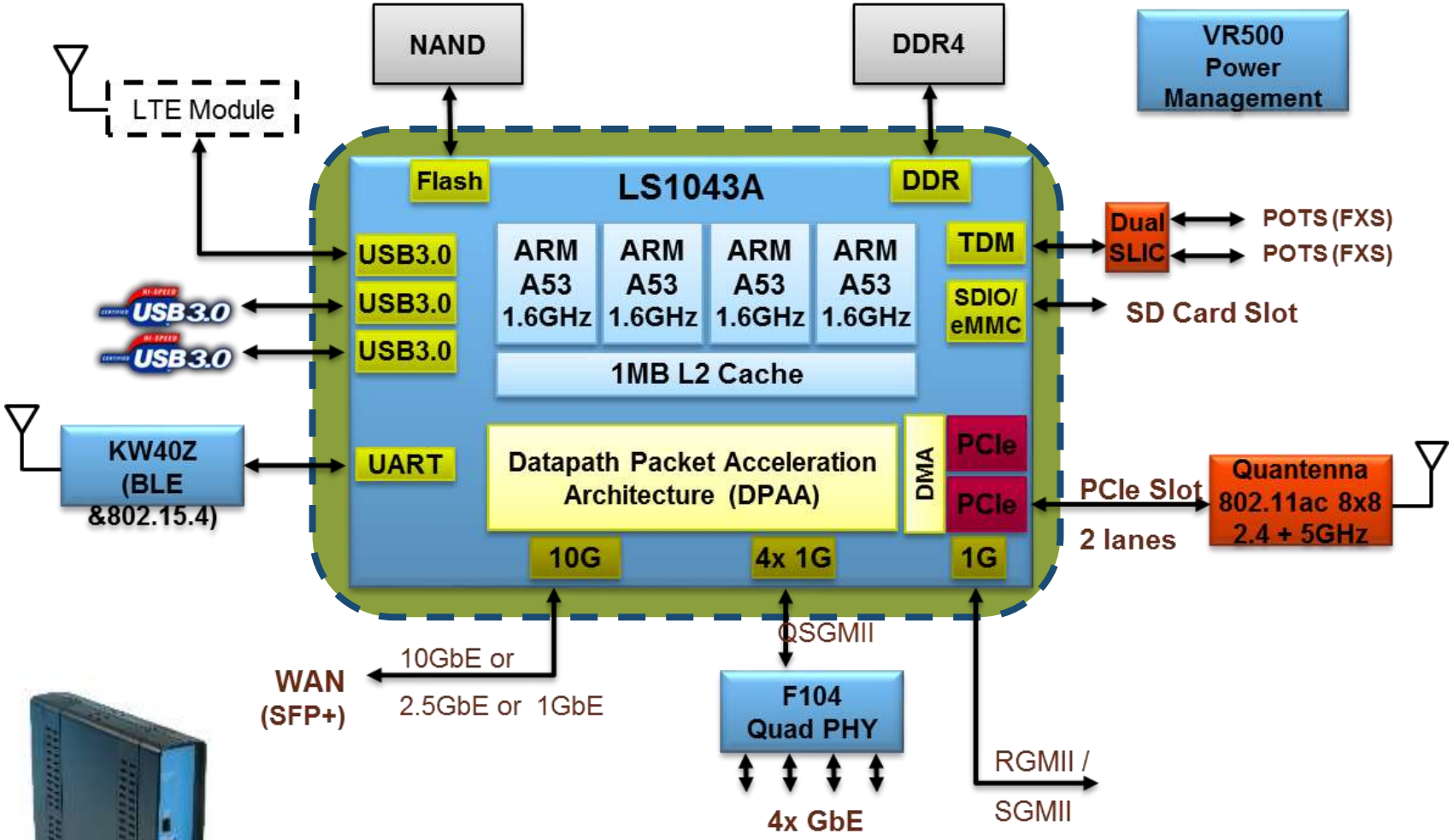
- Dual Gigabit WAN ports for load balancing and resiliency
- Built in 4 LAN ports for high-performance connectivity
- Web Filtering
- Strong security with proven stateful inspection (SPI) firewall and hardware encryption
- High-capacity, high-performance, SSL and IP Security (IPSec) VPN capabilities
- 2 USB ports to support addition capabilities
  - 3G/4G modem
  - Flash drive
- Easy setup and deployment with an intuitive, browser-based device manager and setup wizard



Broadband Gateway System: NXP Differentiaton

- Carrier Gateway Requirements → ***Multiprotocol***
  - ***Line-rate packet processing***: NAT/Firewall, PPPoE, 4o6, 6o4, Multicast, RTP, etc.
  - Hardware QoS integrated with high quality VoIP solution
  - ***Production-grade*** SW platform with flexibility to support new protocols
  - 10-30K Coremarks CPU headroom for service provider and 3rd party apps
  - ***Multi-protocol access*** solution which supports the “Gigabit” speed race (copper infrastructure is being augmented/replaced by Fiber & fixed wireless)
  - Support for latest Wi-Fi standards (moving target), including whole home coverage and QoS
  - Contain system cost and power budgets – ***fanless design required***
  - Linear scaling from ***one to many cores*** for performance (NXP differentiator)

LS1043/23- Next Generation platform for 10G Gateway platform



Most efficient quad core communications SoC

Processor
- 4x A53, 64b, up to 1.5GHz
- 1MB L2 cache shared by all cores and platform

Memory Subsystem
- 32b DDR3L/4 Controller up to 1600MHz

CCI-400 Switch Fabric
- Advanced VM hardware support

High Speed Serial IO
- 3x PCIe Gen2 Controllers
- 1x SATA 3.0, 6Gb/s
- 3x USB 3.0 with PHY

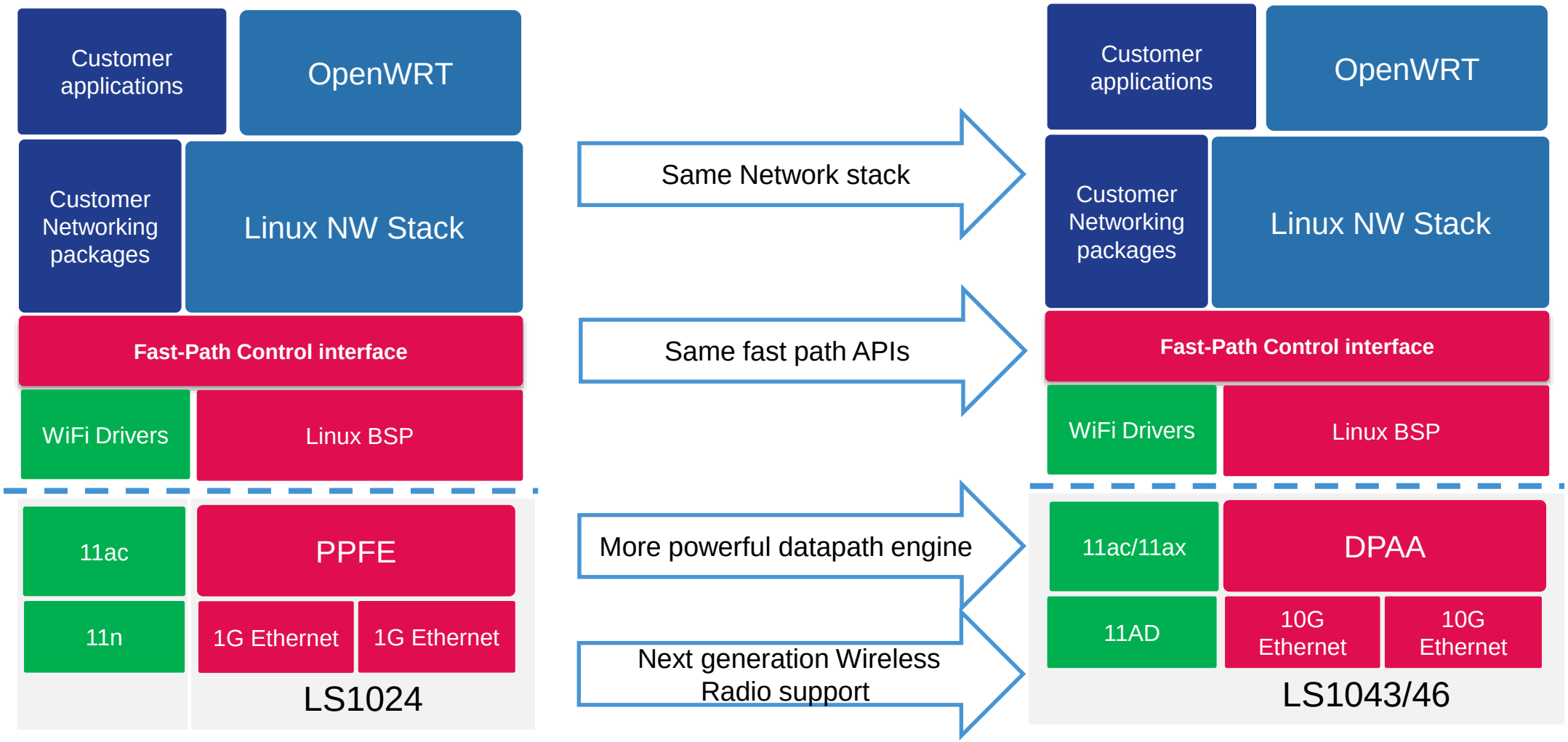
Network IO
- 1x10G + QSGMII or 3x 1/2.5G SGMII + 2x 1G RGMII
- DPAA Proven Packet Parse/Classify/Distribute
  - Up to 2.5Gbps IMIX
  - IPSec, GRE, CAPWAP, DTLS Offload
  - Lossless Flow Control

Data path Acceleration
- SEC- crypto acceleration
- L2/3 & Custom Classification
- Tunnel Header Offload
- Reassembly
- Traffic Management & Shaping

Device: FCBPGA, 0.8mm pitch

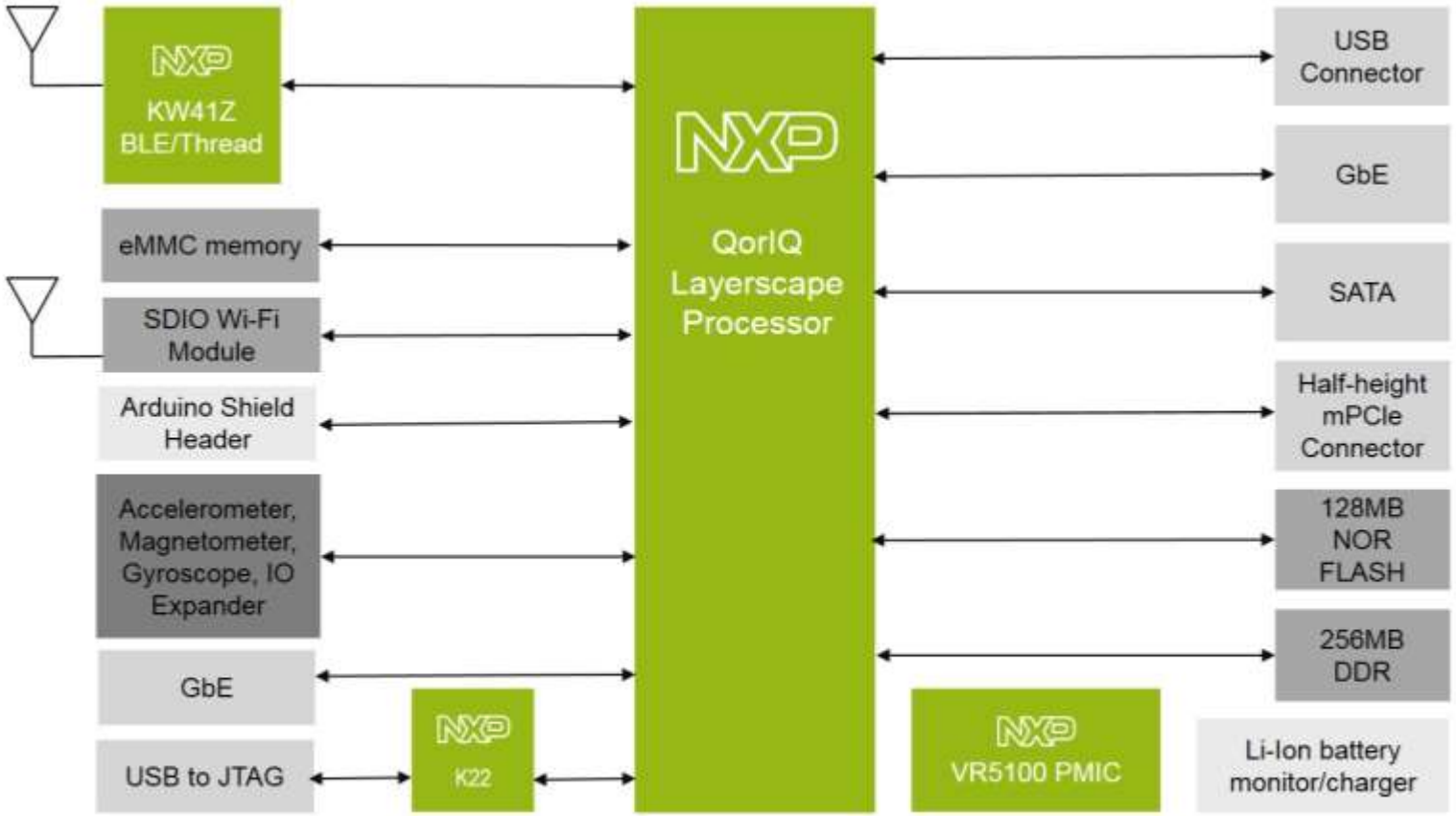
Power: **4**-8W

Preserve the SW Stack: Migration from LS1024 to LS1043



Smart Home Gateway Solution: Proven Connected, Secure,

- **Commercial Software Solution** 10M+ systems deployed
- **Enterprise Security** for Residential and Industrial
  - Secure Data/Communication: Encryption
  - Platform Control: Tamper Detection
  - Authenticate: Secure Boot
- **Popular Connectivity**
  - Gigabit Ethernet for LAN and WAN connectivity
  - WiFi – High speed wireless with support for 802.11ac
  - Zigbee - Home Automation, Home Security, and Energy Control applications
  - Optional: Arduino shield header for expansion
- **Open Software Environment**
  - OSGi/JVM based platform for third party application support



Smart Home Gateway: Proven Connected, Secure (LS1012A)

Complete Turnkey Solution
- Deliver complete solution HW and SW based on customer requirement

Commercial Turnkey Software Solution
- 10M+ systems deployed
- Market proven in service provider networks

Enterprise Security for Residential and Industrial
- Authenticate: Secure Boot
- Platform Control: Tamper Detection
- Secure Data/Communication: Encryption

Popular Connectivity
- Gigabit Ethernet for LAN and WAN connectivity
- WiFi – High speed wireless with support for 802.11ac
- Zigbee - Home Automation, Home Security, and Energy Control applications
- Optional: Arduino shield header for expansion

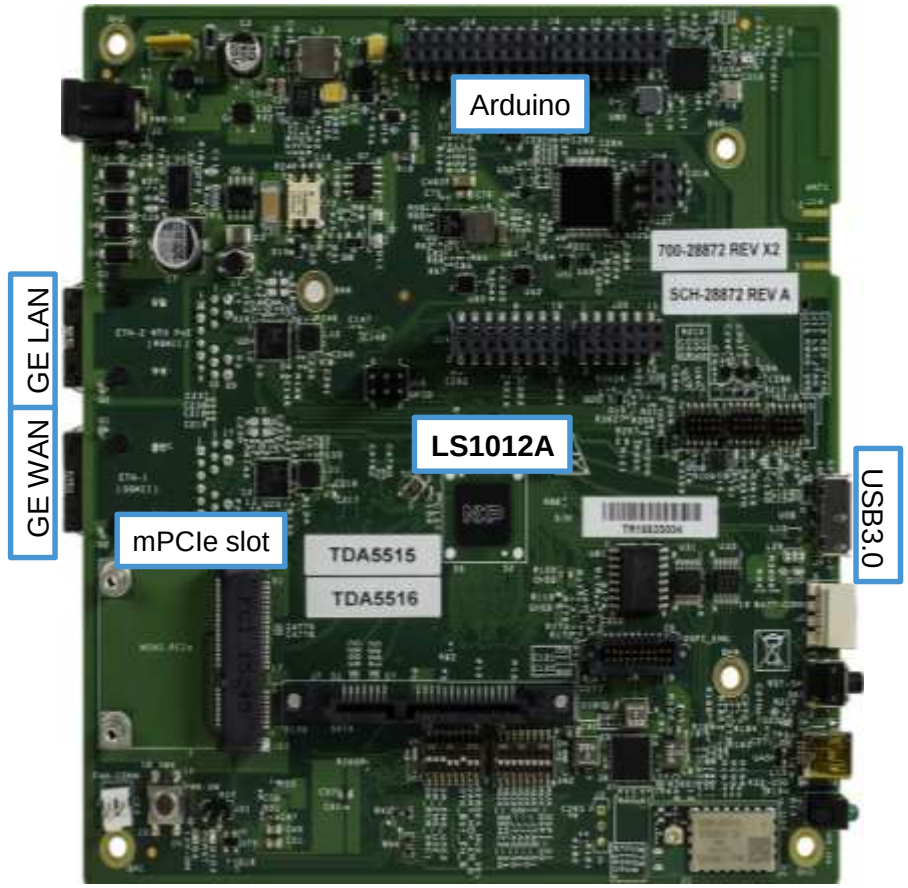
Open Software Environment
- OSGi/JVM based platform for third party application support

Turnkey S/W
Off the shelf S/W solution

TrustZone System Security by ARM

Home Security

Home Router & Access Point



Wi Fi
ZigBee
Bluetooth SMART
THREAD

IoT Gateway Solution: Proven Connected, Secure (LS1021A)

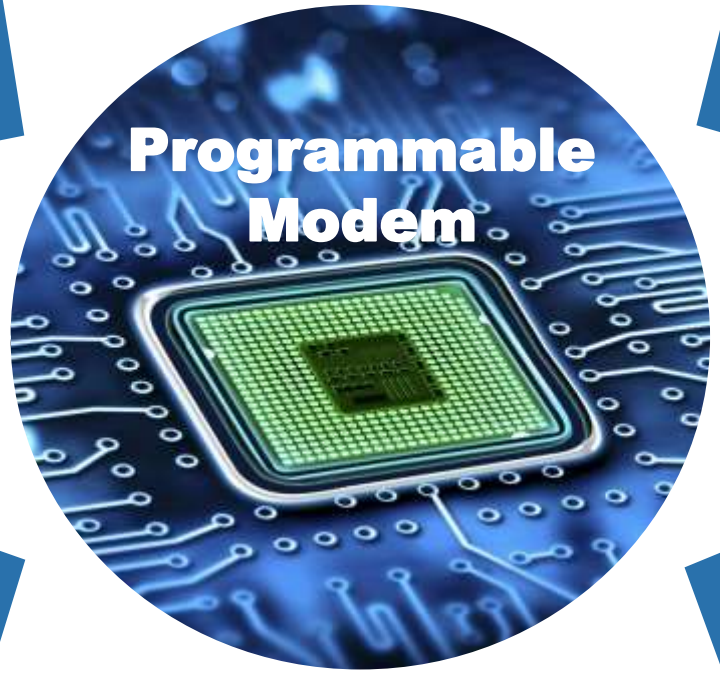
Security
- Authenticate: Secure Boot
- Platform Control: Tamper Detection
- Secure Data/Communication: Encryption
- Trusted Applications: TEE

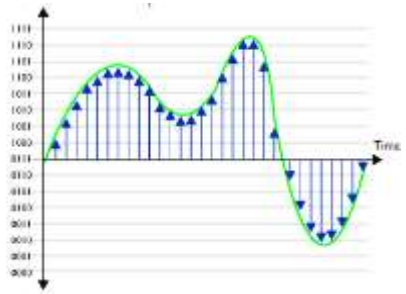
Popular Connectivity
- Gigabit Ethernet for LAN and WAN connectivity
- WiFi – High speed wireless with support for 802.11
- Optional: Arduino shield header for expansion
  - Zigbee - Automation, Security, and Energy Control applications
  - Thread – Home Automation, Security
  - BLE – Home Automation
- USB 2.0 and 3.0

Open Software Environment
- Docker based container environment
- OpenWRT/LEDE Support
- SD Boot
- Thread/BLE/NFC drivers

Why a programmable modem NOW?

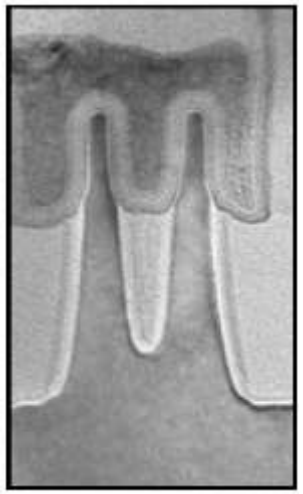
Standards convergence





High performance analog-digital converters

16nm finFET CMOS technology



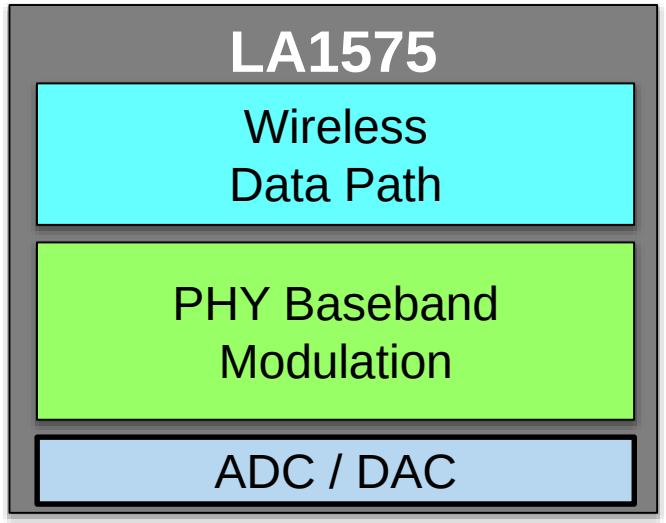
VSPA Signal Processing Accelerator

Layerscape LA1575 Programmability

Previous Method

- Inflexible
- Limited upgradability
- Vendor dependency
- Limited scaling

NXP Programmability Innovation



New Layerscape Architecture

Programmable PHY

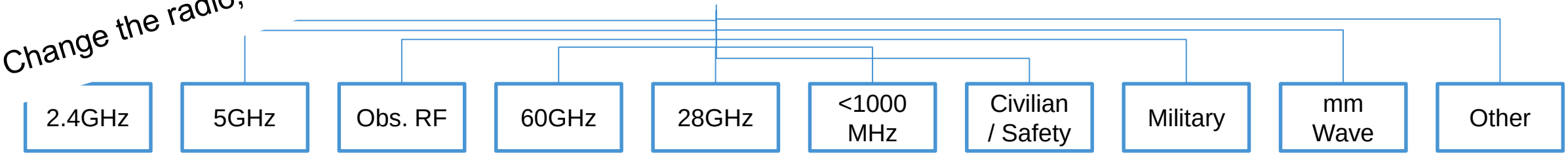
- Pre-standard protocol support
- Custom modulations
- New wireless protocols & updates
- Advanced radio management

Custom MAC / Packet Processing

- Wireless, Packet & Crypto offload
- Hardware based processing

New Protocols: Fast time to market
Field Upgrades
Features Differentiation
Development reuse

Change the radio, not the SoC



Many protocols and configurations, one architecture

02.
Industrial Solutions

Industrial Markets for NXP Solutions

Factory and Infrastructure

Production and & Facility Monitoring

Manufacturing Control

Process Control

Water Treatment, Oil & Gas

Energy Generation, Transmission & Distribution

Military and Aerospace

Drones

Avionics Control

Military Vehicles

Transport

Rail Systems

Mobility and Logistics

Industrial Vehicles

Industrial Networking

IoT Gateways

Industrial Gateways

Industrial Switches

Routers

Access Points

Industrial Requirements

- Fanless operation – SoC power consumption <5 W
- Extended temperature: -40 to 105 deg C, 125 deg C
- Supply longevity – 15 year+ product availability
- Product longevity and reliability – 10 year continuous operation
- Deterministic Ethernet – TSN, AFDX, EtherCAT, Profinet, Sercos, Powerlink
- Low latency, real-time OS – control loops running at 30-150 usec
- Secure platform
- Packet processing offload for gateways/access points
- Interfaces
  - PCIe RC & EP, Parallel Bus, Gigabit Ethernet, CAN, UART, I2C, SPI

Factory Automation and Infrastructure

- **Products**
  - PLCs
  - Motion/Robotics Controllers
  - CNC
  - Power Relay
  - Voltage protection
  - Power quality detection
  - Power distribution networks
- **Requirements**
  - Low Power
  - Extended temperature
  - Supply Longevity
  - Product Life
  - Low Latency
  - Real-time OS
  - Secure Platform
  - Deterministic Ethernet (TSN, HSR, Profinet, EtherCAT)

S&C SIEMENS NARI 国电南瑞 NARI-TECH MITSUBISHI

ABB FANUC KUKA

YASKAWA OMRON

Military and Aerospace

- Products
  - Flight Management Systems
  - Integrated Avionics System
  - Navigation Computer
  - Avionics Gateway
  - Radar Control
  - Broadband communications



- Requirements
  - Long life – production for 20+ years
  - Low power, fanless
  - Support for safety certification
  - Secure platform
  - Deterministic networking (AFDX)



CURTISS-WRIGHT LOCKHEED MARTIN AIRBUS Computer Systems, Inc. MERCURY

THALES BAE SYSTEMS Rockwell Collins Honeywell BOEING

Transportation

- **Products**
  - Train routing
  - Train monitoring
  - Train communications
  - Shipping RADAR
  - Power Conversion
  - Public Access Points
  - Gateway
  - Engine Controllers
- **Requirements**
  - Supply Longevity
  - Product Longevity & Reliability
  - Extended Temperature
  - Real-time OS
  - Secure platform
  - Data throughput (access points/gateways)
  - CAN interface, parallel bus, Ethernet, PCIe






kapsch challenging limits

ELTEC systems

GE Transportation

ABB

MITSUBISHI

Industrial Networking

- **Products**
  - Industrial Switches
  - Access Points
  - Industrial Gateways
  - IoT Gateways
- **Requirements**
  - Extended temperature
  - Bandwidth
  - Supply Longevity
  - Low Power
  - Secure Platform
  - Encrypted Communications
  - Packet Offload
  - Free processing for analytics





MOXA® Industrial Network Solution

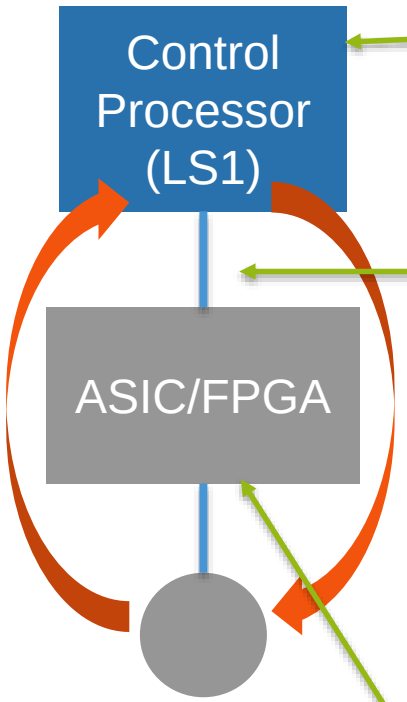
westermo®

SIERRA WIRELESS

BELDEN

PHOENIX CONTACT

Manufacturing Automation Requirements



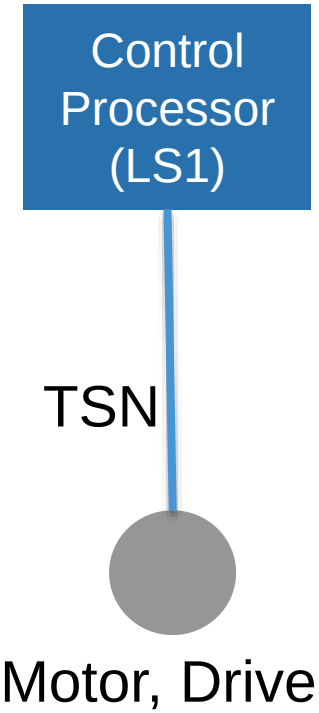
Processor runs RTOS
Xenomai Linux, VxWorks, Mentor Nucleus RTOS
GreenHills OS, Pike OS, Others

PCIe or 16 bit parallel bus
Depends on data sizes, customer preference

Control loops run every 25-150 usecs
Requires low latency, deterministic latency
Control loop timing determines how fast and how smoothly a mechanical system can run

ASIC or FPGA provide Industrial Protocols
(Low Latency, Determinism)

Future Systems



03.

Wireless

Wireless Solutions: Differentiating with Software and Silicon

Ubiquitous Connectivity

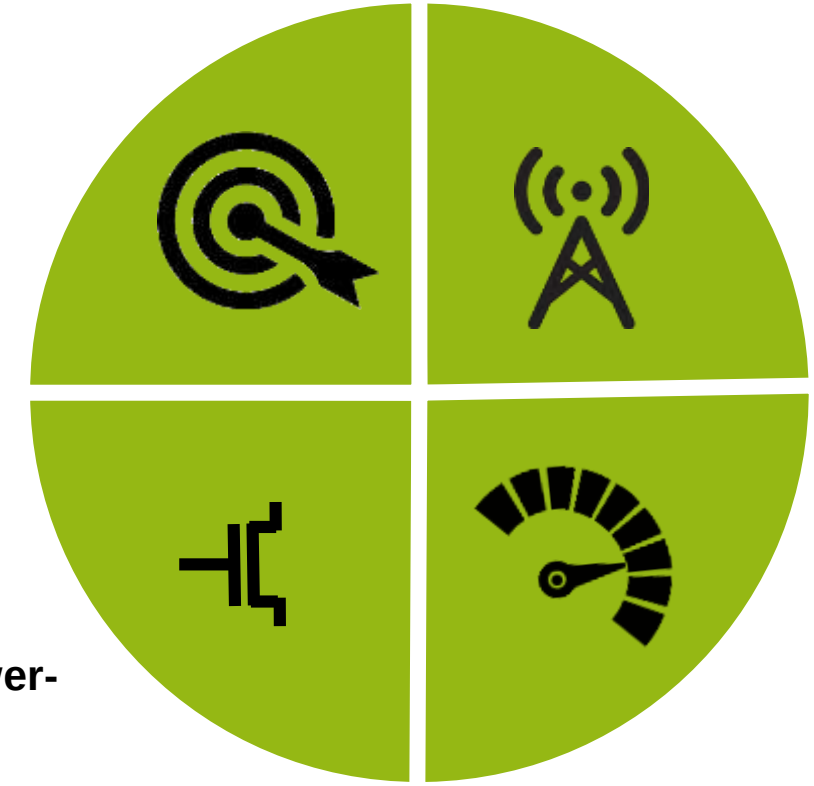
✓ ***Flexible & Complete Connectivity Solutions***

Portfolio of Wi-Fi & Cellular Solutions

Low Power

✓ ***Small & Cool***

Optimized software and power-efficient hardware



Network Densification

✓ ***HetNet solutions for 3GPP Evolution***

Global field deployment

Wireless Convergence

✓ ***SW Configurable High Performance Solutions***

Universal access architecture

Wireless: ODM Solutions

senao

Wave2 802.ac Dual-band

- T1023 with 10G/2.5G Support
- PoE Plus 3at
- 3x mPCIe to support 3-radios
- IoT Connectivity support

Accton
Making Partnership Work

Tri-band Wave2 802.11ac

- LS1043A with 10G/2.5G Support
- HW offload for IPSec & CAPWAP/DTLS (5Gbps)
- PoE Plus 3at
- 3x mPCIe to support 3-radios
- Support for 60GHz 802.11ad mm-wave
- IoT Connectivity support

Accton
Making Partnership Work

IgniteNet™

MetroLinq™ 60

Cloud-Enabled Outdoor 60GHz PTP + 5GHz

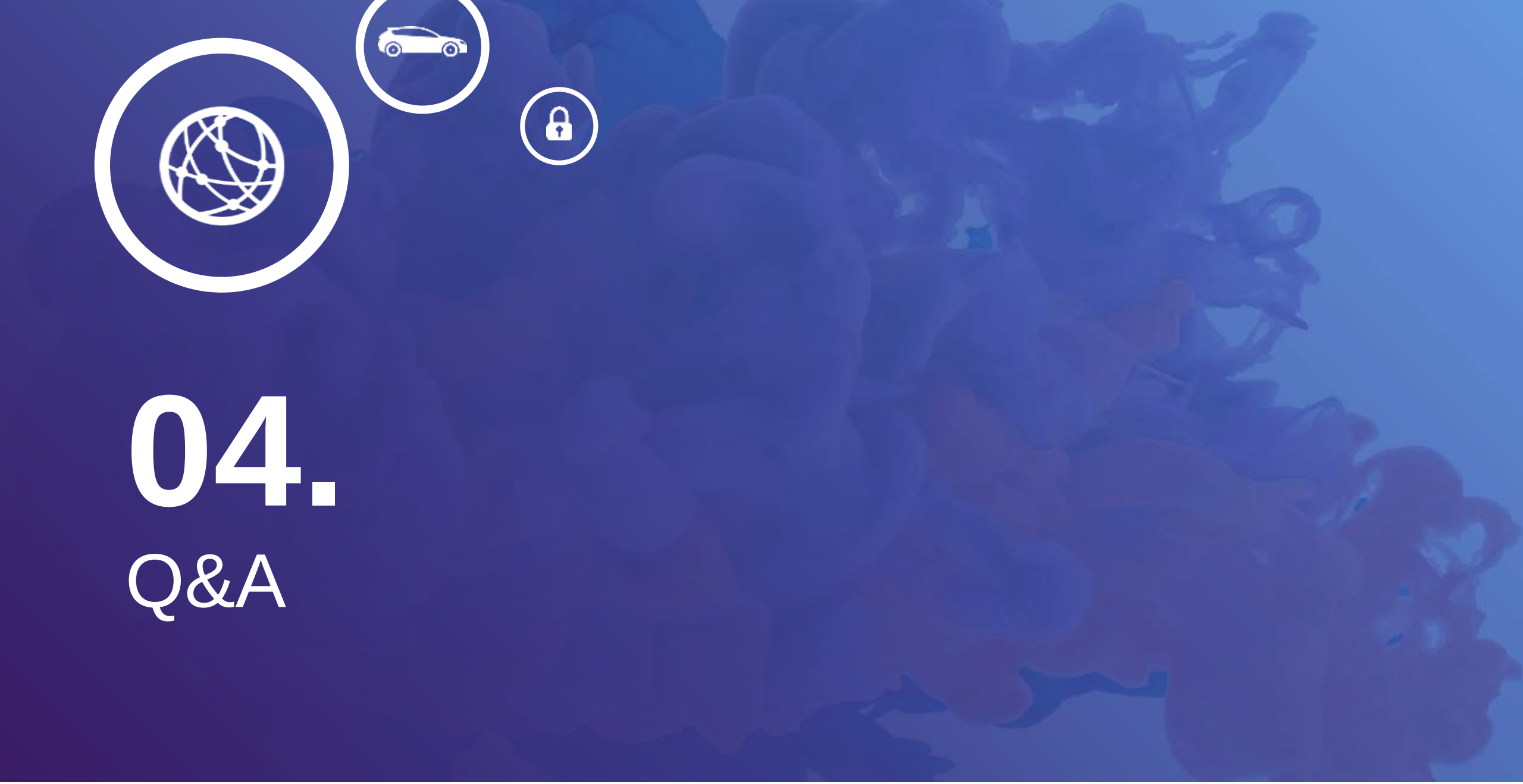
60GHz PTP/PTMP Solution

- World's first cost-effective 60GHz PTP/PTMP radio
- LS1043A based PTP client
- LS1043A based station sector

Summary

- High performance and scalable modular gateway solutions
- Common network stack and offload APIs across all platforms to ease migration & support costs
- Optimized hardware data path for all known work loads
- Supports Next gen wireless standards such as 11ac wave2, 11ad & 5G out of the box
- Supports multitude of carrier access standards including 10G PON
- Reference designs available now from leading ODMs.

Ready to Start Designs with you Today!



04.

Q&A

SECURE CONNECTIONS
FOR A SMARTER WORLD