Cascade™ Platform – MEMS Clock-System-on-a-Chip

August 4, 2020

SiTime®

SiTime Timing Makes 5G Vision a Reality

10x

Faster

10x more accurate time synchronization

10,000x

More Traffic

10-100x

More Devices

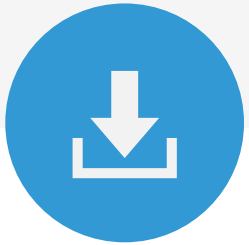
Better environmental resilience

50x

Lower Latency

Zero

Perceived Downtime



Higher reliability, lower power

90%

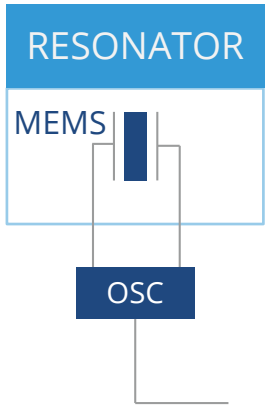
Less Energy

Sources: 3GPP, Nokia, 5G-PPP

SiTime's Core Competence is Foundation for All Timing Devices

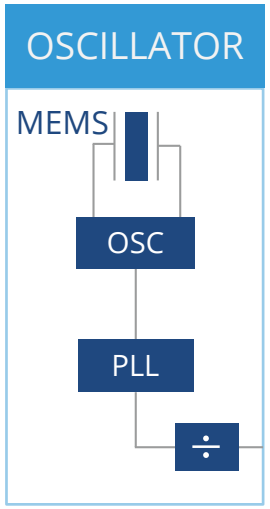
SiTime Heritage → Natural Evolution

RESONATOR



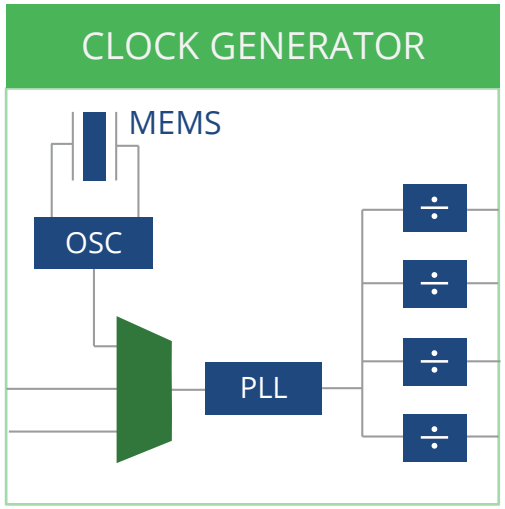
- Passive device
- External osc. circuit

OSCILLATOR



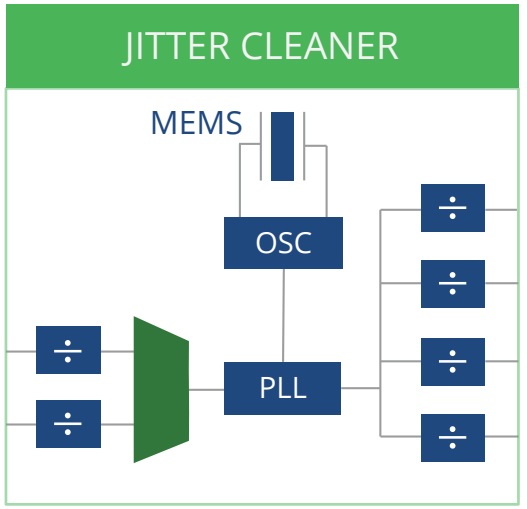
- Active device
- 2 chips in package
- One output

CLOCK GENERATOR



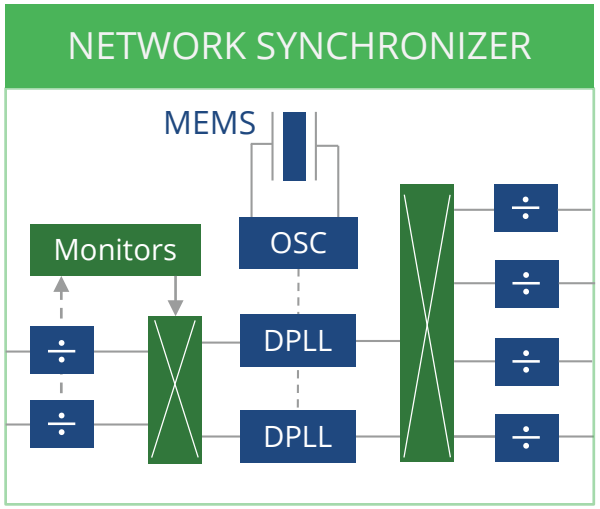
- Active device
- 2 chips in package
- Multiple outputs
- 1 or more PLLs
- Optional inputs

JITTER CLEANER



- Active device
- 2 chips in package
- Multiple outputs
- One or more inputs
- Removes input jitter

NETWORK SYNCHRONIZER



- Active device
- 2 chips in package
- Multiple outputs
- One or more inputs
- Removes input jitter
- Multiple clock domains for sync

End Market Overview – Communications and Enterprise

Drivers

- 5G network densification
- Faster expansion of cloud
- Miniaturization of edge devices

Why SiTime MEMS?

- Better precision under changing temperature
- Increased stability under vibration
- Higher reliability


SMALL CELL


4G+ / 5G RRH

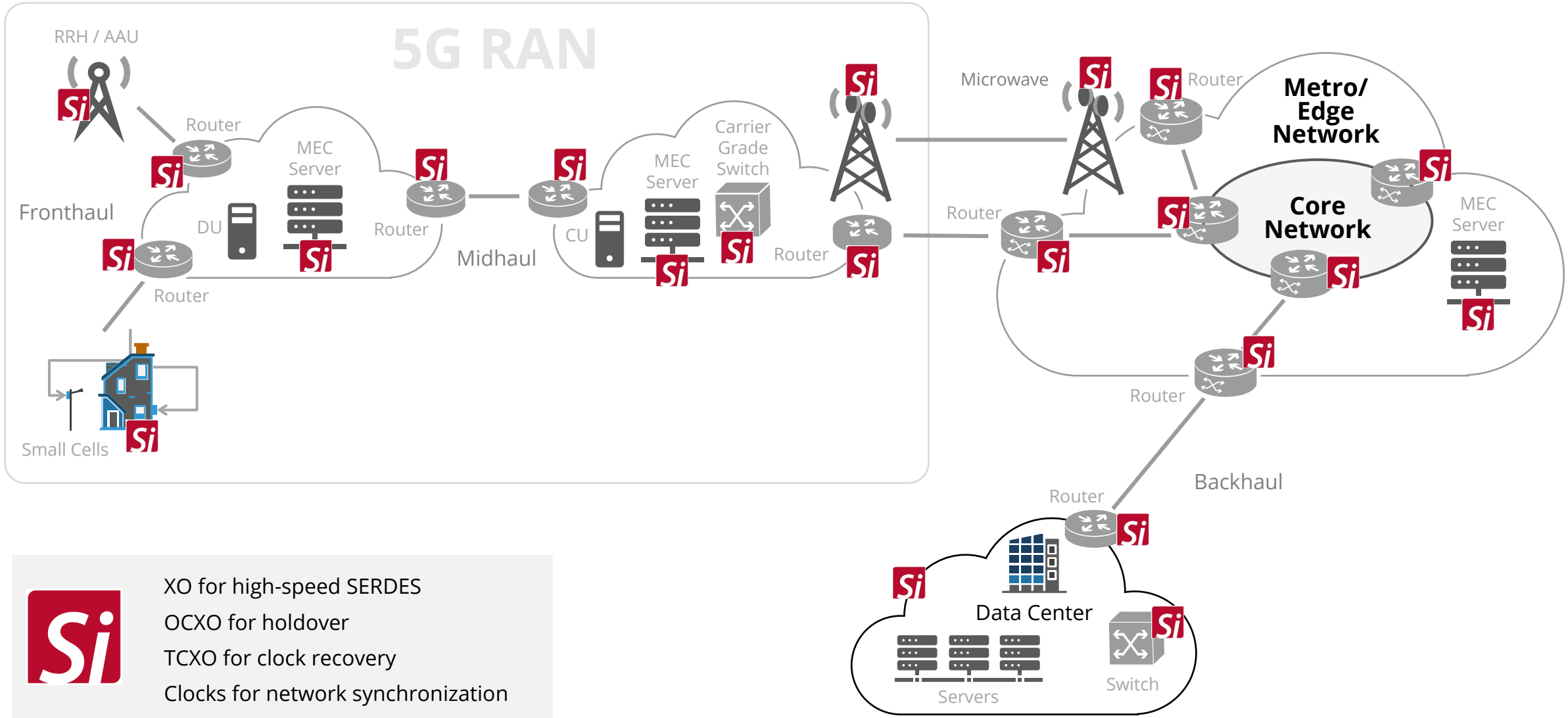

OPTICAL MODULE


ENTERPRISE SWITCH


SERVER


SMART NIC

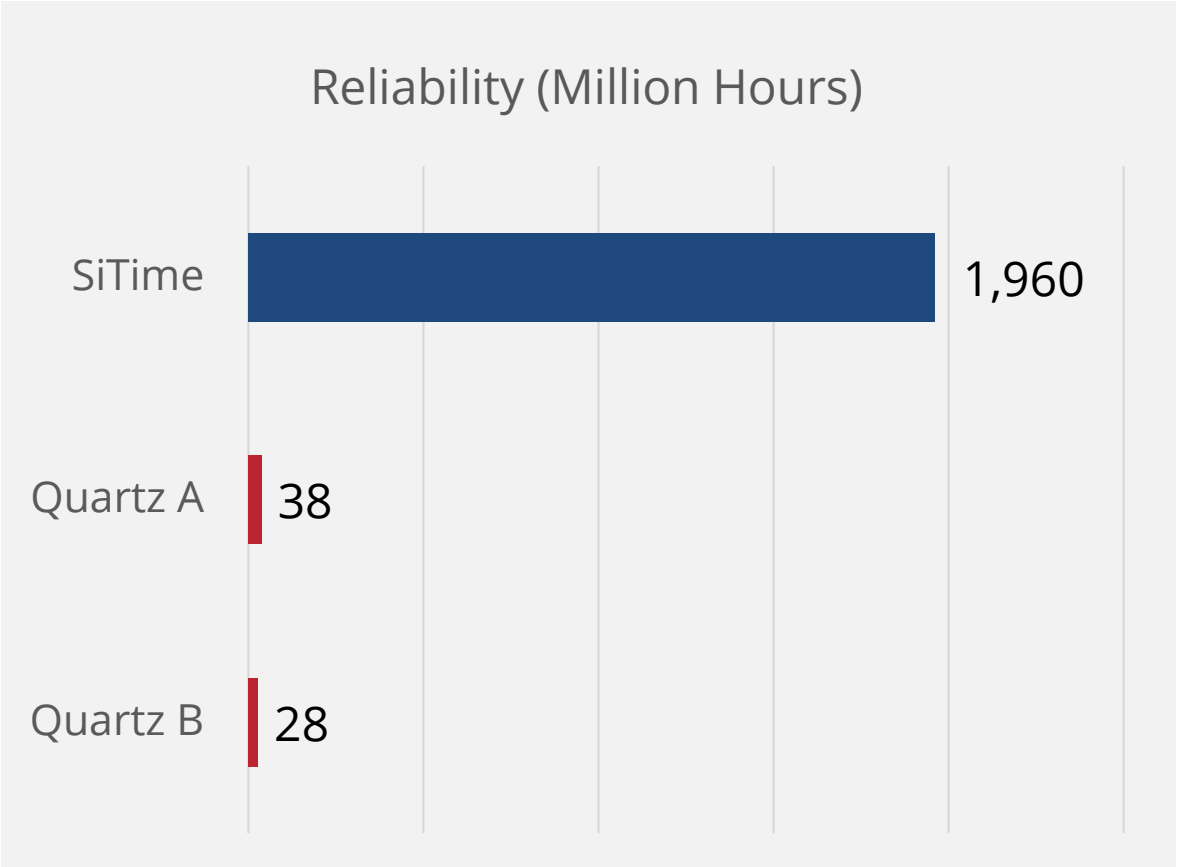
SiTime Empowers 5G Network Connectivity



XO for high-speed SERDES
OCXO for holdover
TCXO for clock recovery
Clocks for network synchronization

Best-in-Class Reliability

1,960M hours MTBF – 50x better reliability than quartz

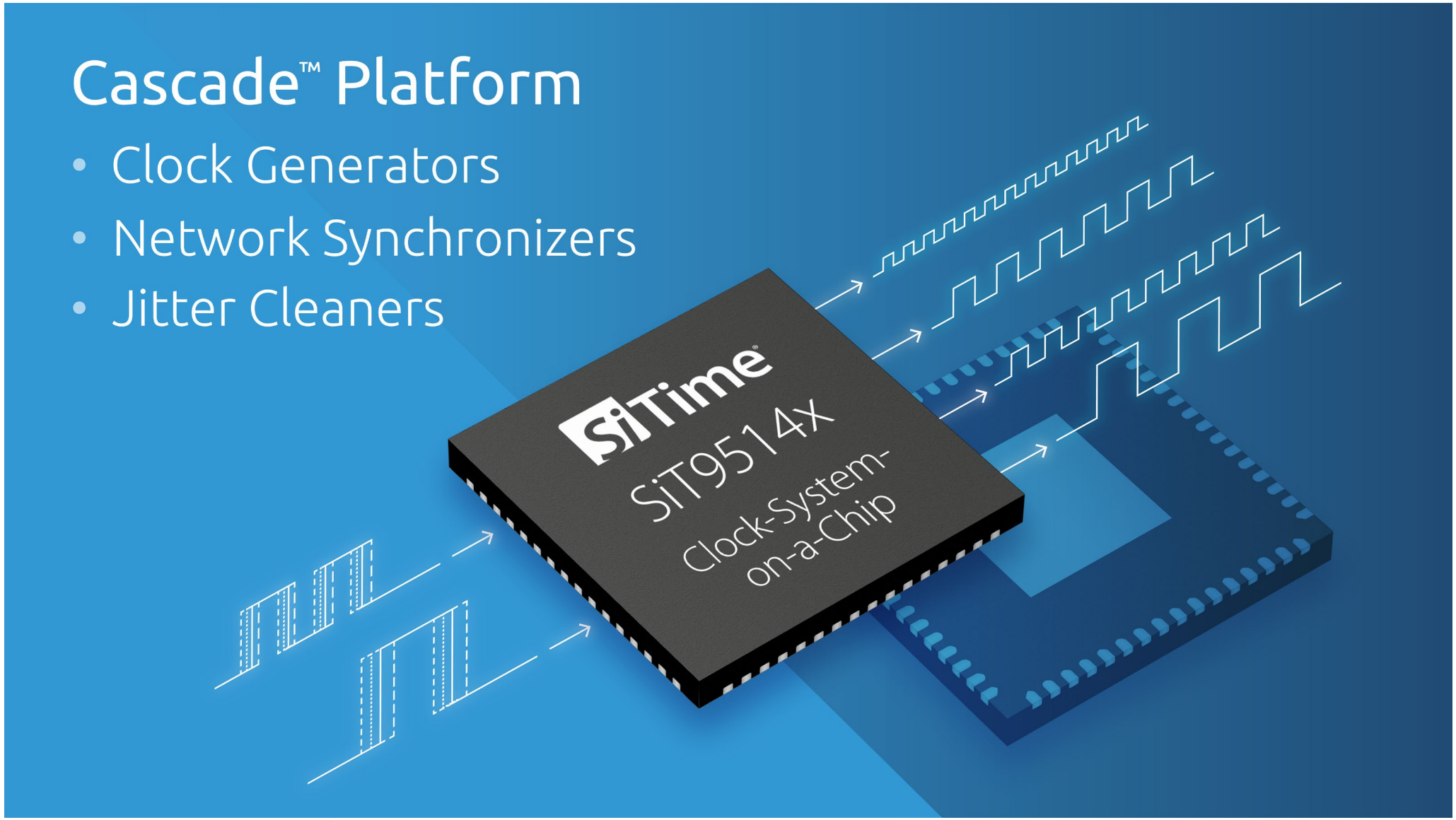


Vendor	MTBF (Million hours)	Predicted Failures per Year per 10,000 Units
SiTime	1,960	0.04
Quartz A	38	2.3
Quartz B	28	3.1

SiTime Solves Timing Problems in 5G Infrastructure

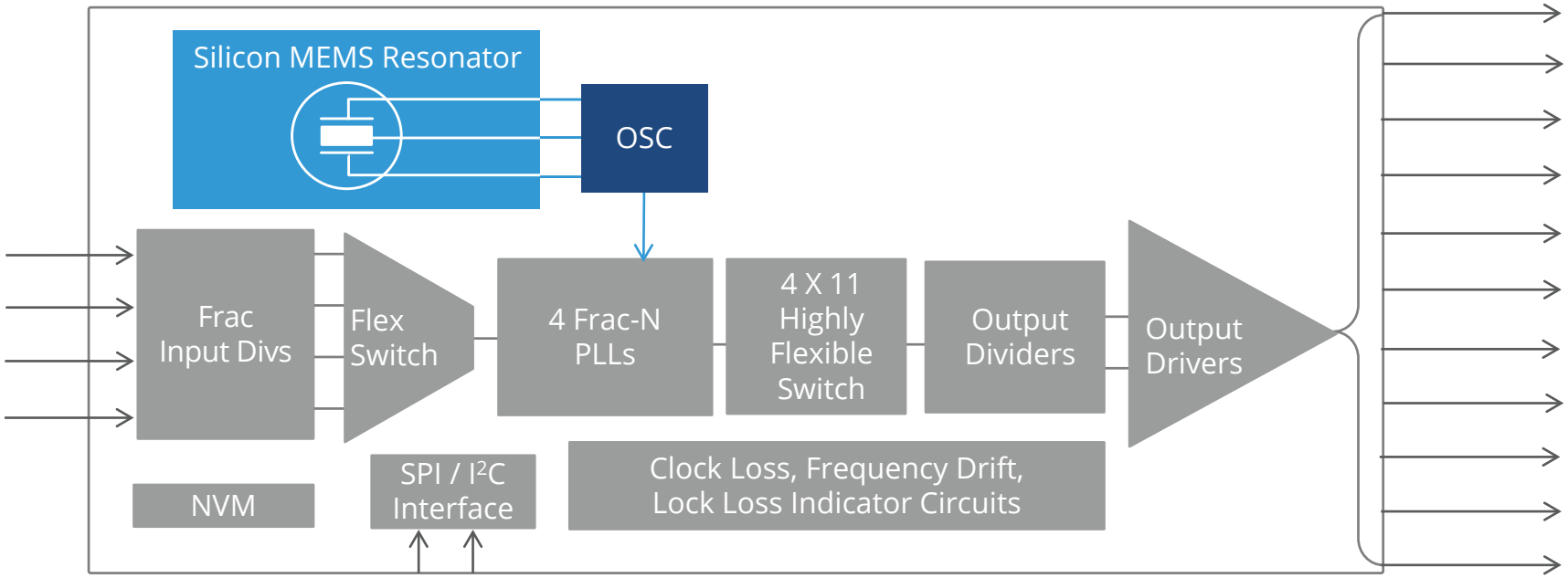
Network Devices	5G Requirement	SiTime Value	SiTime Products
Radios, BBU, Switches, Routers	• Outdoor deployment • Zero perceived downtime • Higher reliability	• Environmental resilience • Flexible input monitoring, switching • MEMS reliability	*SiT9514x*
Switches, Routers, Radios	• 10x tighter time synchronization • Outdoor deployment • Higher reliability	• 4x better ΔF/ΔT • 20x better *g*-sensitivity, 105 °C • 40x better MTBF	Elite TCXO Emerald OCXO
Optical Modules	• 4x faster • Less power/bit • Denser designs	• Lowest jitter • 2x more robust to supply noise • 50% smaller	*SiT9501 XO*

10x More Reliable, Enables 5G Vision



SiT9514x “Clock System-on-a-Chip” Integrates MEMS for Highest Reliability

Clock Generator • Jitter Cleaner • Network Synchronizer



- Integrated MEMS, no crystal matching or reliability issues
- Up to 4-inputs, 11-outputs, 8 kHz to 2.1 GHz
- Up to 4 digital PLLs for flexible frequency planning
- Any input/output types: LVPECL, LVDS, HCSL, CML, LVCMOS

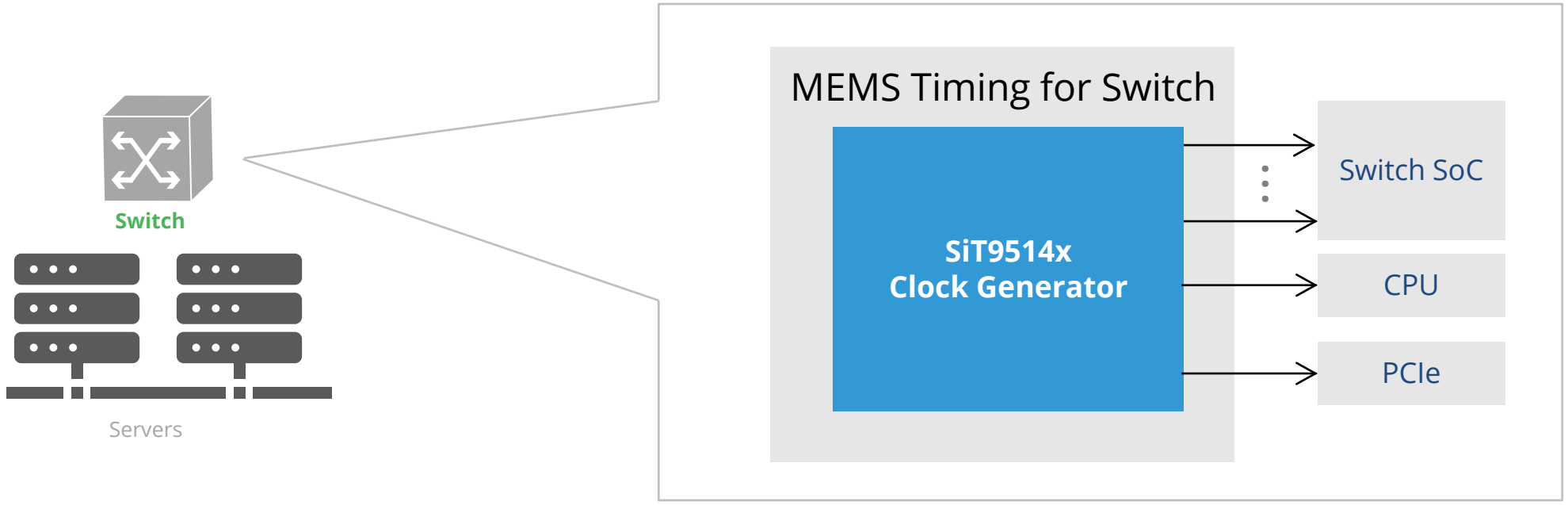
- Excellent phase jitter, 125 fs rms typ. (12 kHz – 20 MHz)
- Programmable PLL loop bandwidth from 1 milli-Hz to 4 kHz
- Flexible operating modes – synchronized, free run or holdover
- DCO mode for IEEE 1588, 5 ppt resolution

Single Device Simplifies Design, Reduces BOM, Saves Space

- 10x more reliable, resilient with integrated MEMS resonator
- Resists supply noise, EMI, shock and board bending
- Provides up to 4 independent clock domains
- Low 1 milli-Hz loop bandwidth to filter wander, network noise
- Fail-safe operation with fast hitless switching between inputs
- Rich programmable features and configuration options
  - Program in-system, or ship pre-programmed from factory

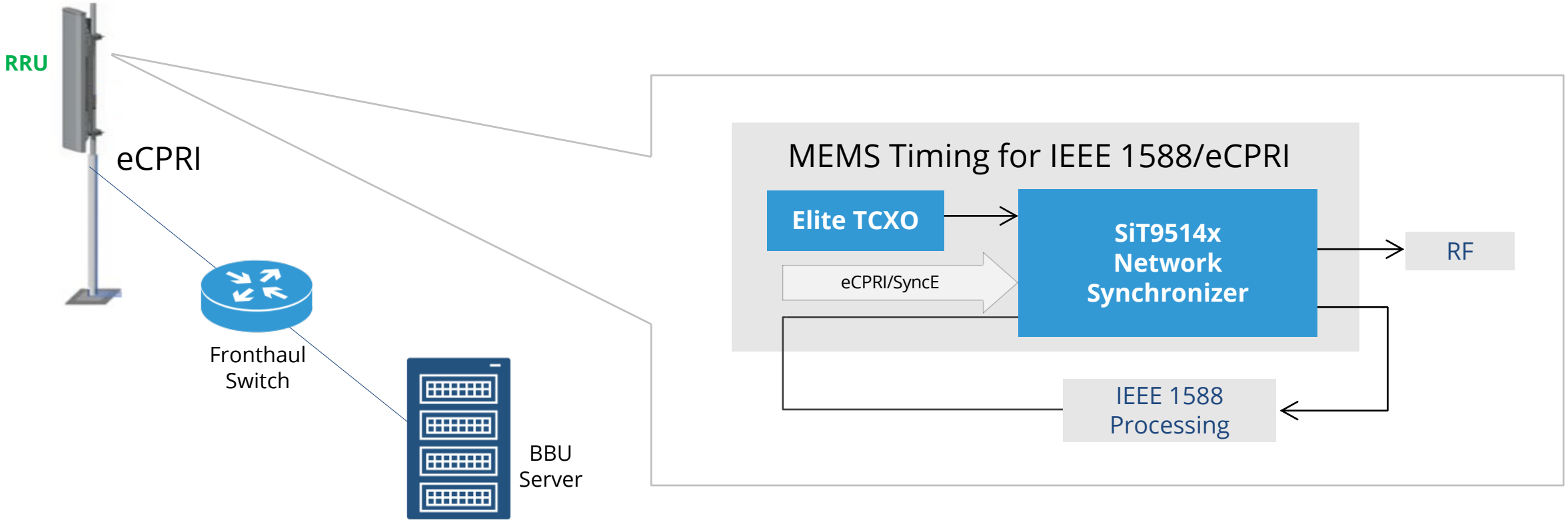
SiT9514x Consolidates all Clocks in Data Center Switch

- Clock-system-on-a-chip with integrated MEMS
  - 10x more reliable, eliminating quartz-related field failures
  - 10x more resilient to supply noise, EMI, shock and board bending
  - Simplifies design, saves space, reduces BOM, speeds time to market



SiT9514x Engineered for Robust 5G RRU Outdoor Deployments

- Environmental resilience enables flexibility to deploy a single-design globally
  - 10x more vibration resistant
  - Reliable startup at cold temperatures
  - Eliminates quartz-related reliability field failures



SiT9514x Enables Zero Downtime in Fronthaul Switches, BBUs

- Flexible input monitoring and hitless switching ensure failsafe operation
- 26 fs phase build-out during switch maintains downstream system continuity
- PLL bandwidths down to 1 milli-Hz optimizes filtering of network timing noise (wander)