

ADAS & Driver Replacement: NXP Radar Solutions

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NXP Automotive Radar Segment

June 2019 | Session #AMF-AUT-T3663



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Agenda

- NXP Radar Processor Overview
 - NXP Processor Values
 - Signal Processing Overview
- Signal Processing Toolbox
 - HW & SW enablement
 - S32R, MMIC, PMIC



#1 Radar Processor Provider

Scalable, highly integrated, safe & secure family driving the digitalization of radar & sensor data fusion

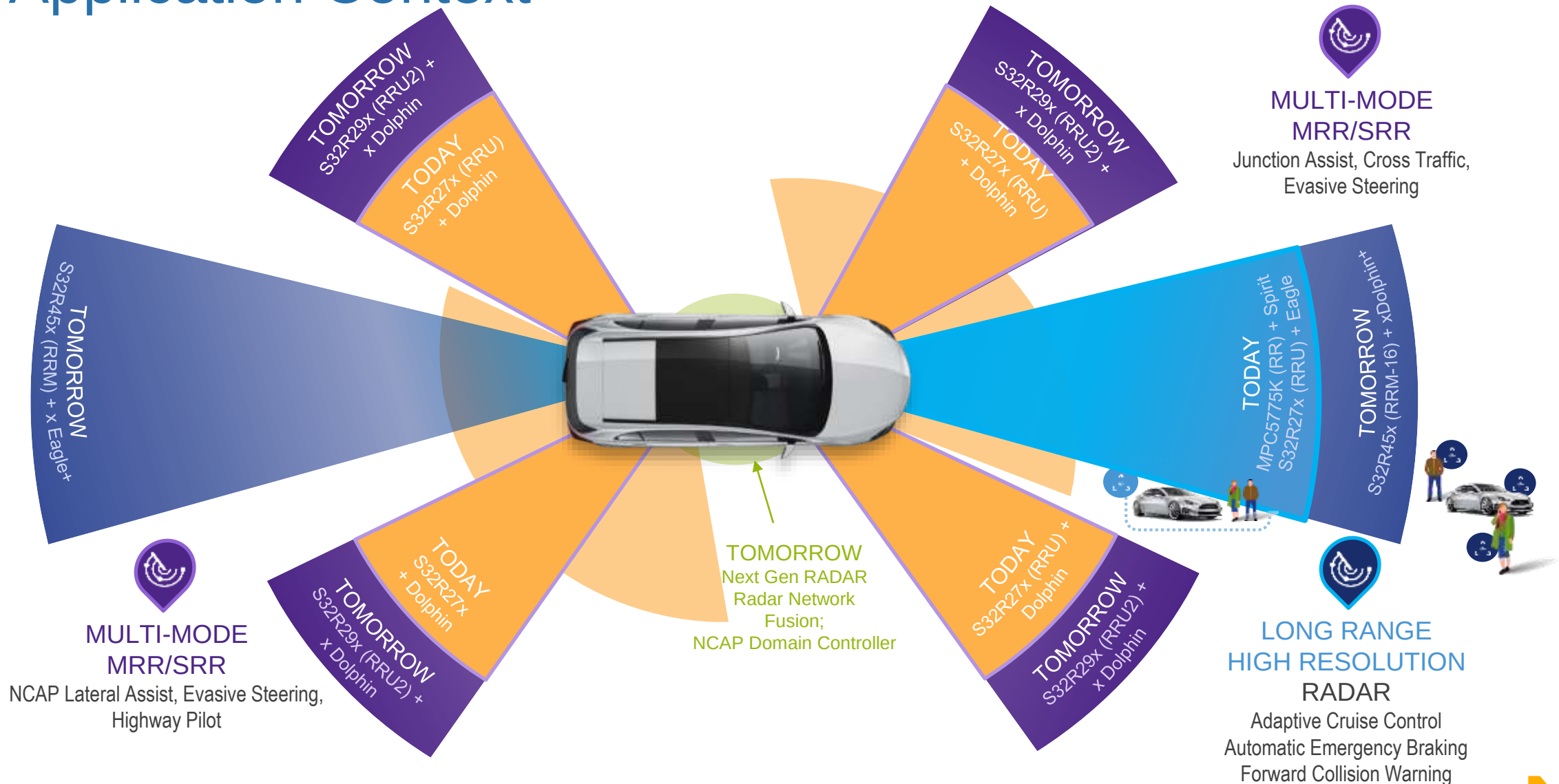
>50%
radar modules use
NXP radar technology in 2018

S32R
Industry-leading
Performance Per Watt



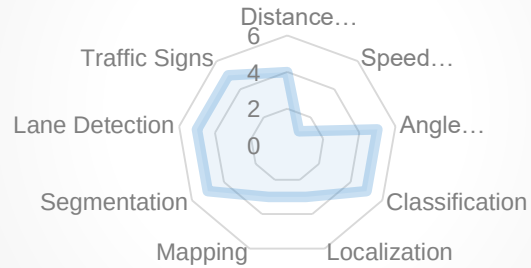
MPC5775K	SPT1.0	World's 1 st Automotive RADAR IP	RADAR SIGNAL PROCESSING TOOLBOX NXP
S32R27x	SPT2.0	Extended functionality	
S32R37x	SPT2.5	Optimized for Efficiency	
NG NCAP	SPT2.8 • 2x performance increase • Maximum reuse	2x Performance Improvement	
NG High Resolution	SPT3.0 • Multi-Threading • DSP integration	~10x improvement in performance	

Application Context



Autonomous Driving – Today's Sensor Capabilities

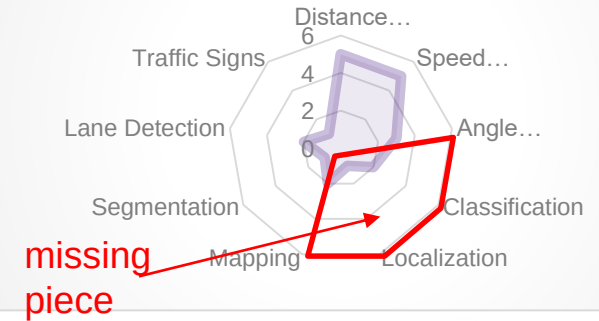
Camera



Lidar



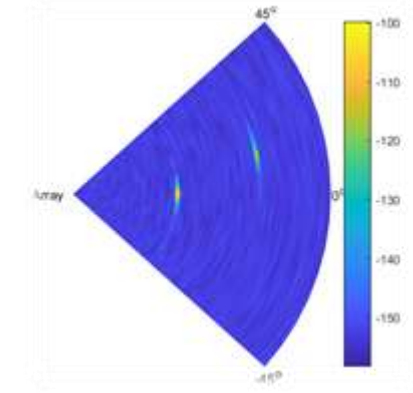
Radar



- Dependency from environmental conditions
- Estimation - No direct measurement of range/speed
- Very high computation effort drives power consumption+ cost



- Cost and size of sensors too high because of mechanics
- Systems w/o mechanics ~10y behind RADAR



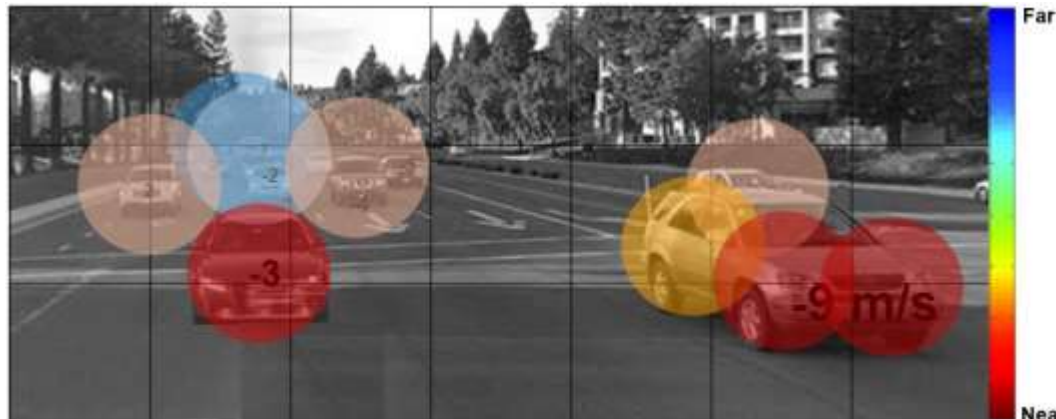
- Precise measurements but lack of resolution mainly in angular direction
- Current angular resolution imposes heavy limit to classification and mapping capabilities

Imaging Radar

- Very High Azimuth and Elevation Resolution Performance
- Mainly for Autonomous Driving Use Cases (L3/L4)

1 MMIC + RRU

Beamwidth
Az 5°
No Elevation

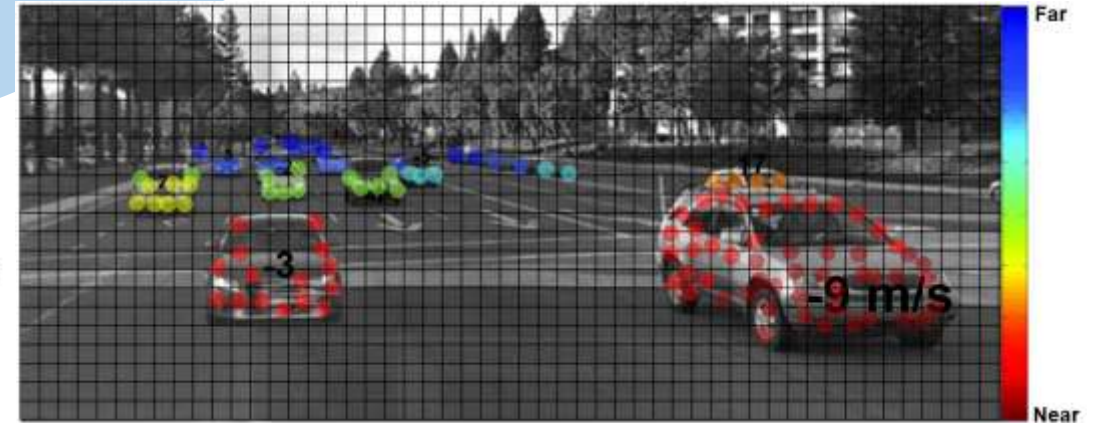


2 MMIC + RRU2

Beamwidth
Az 4° / El 4°

4 MMIC + RRM

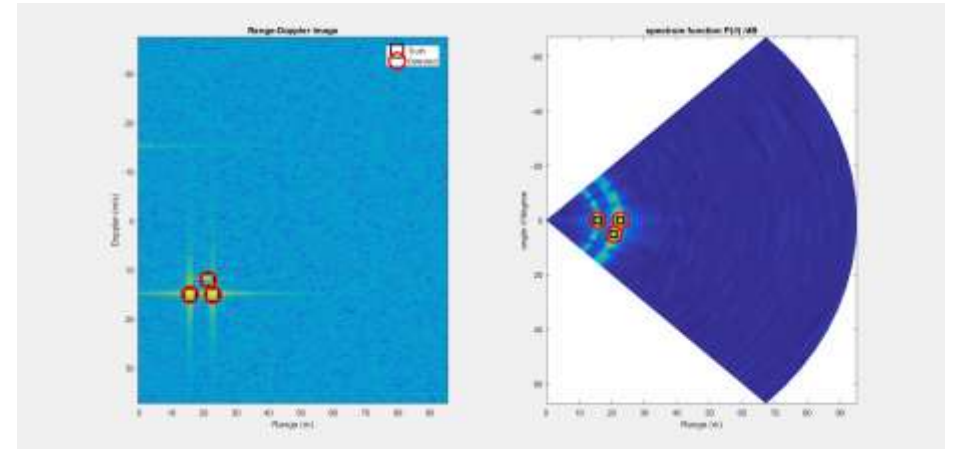
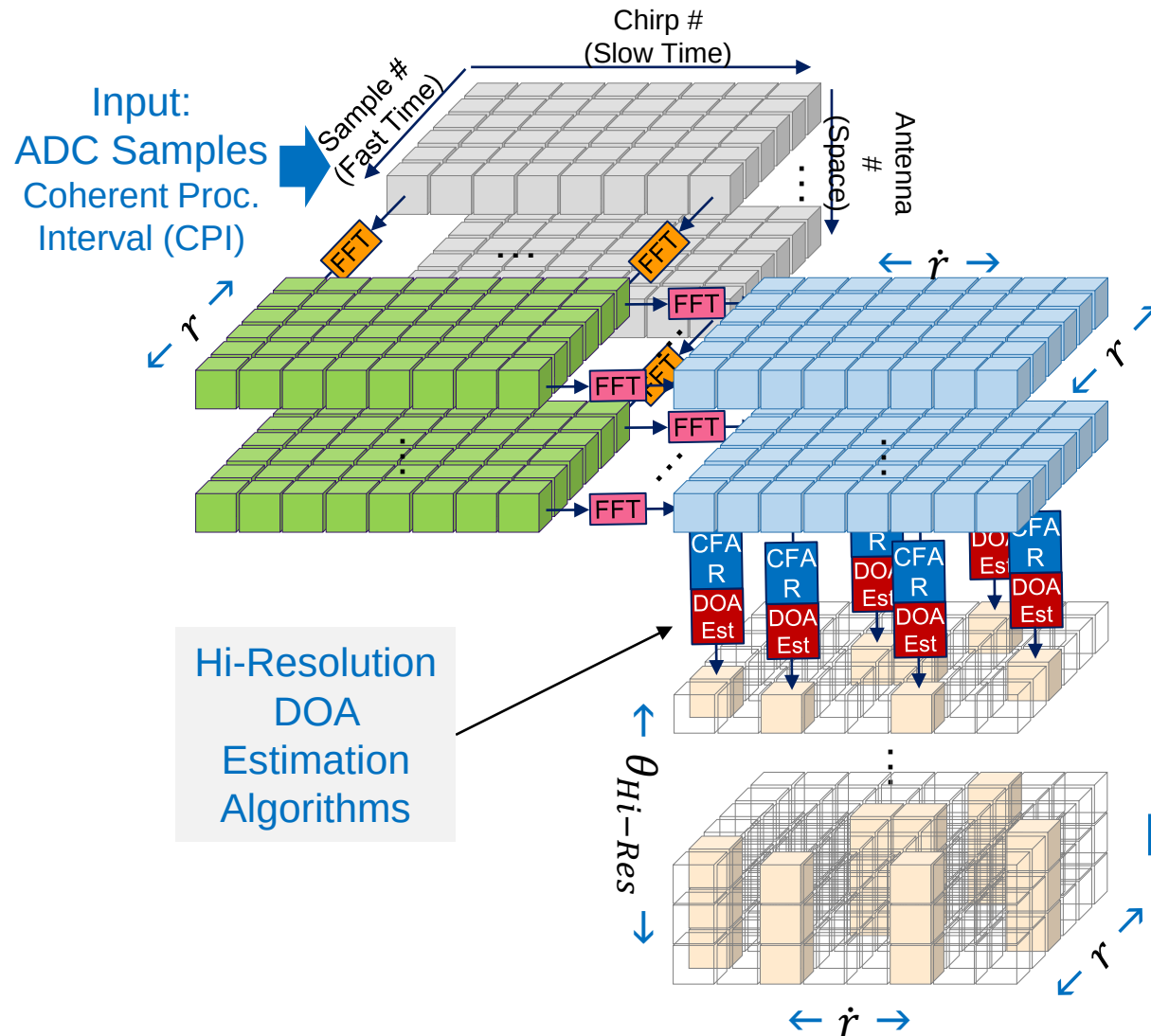
Beamwidth
Az 2° / El 2°



Beamwidth
Az 0.1° / El 0.1°

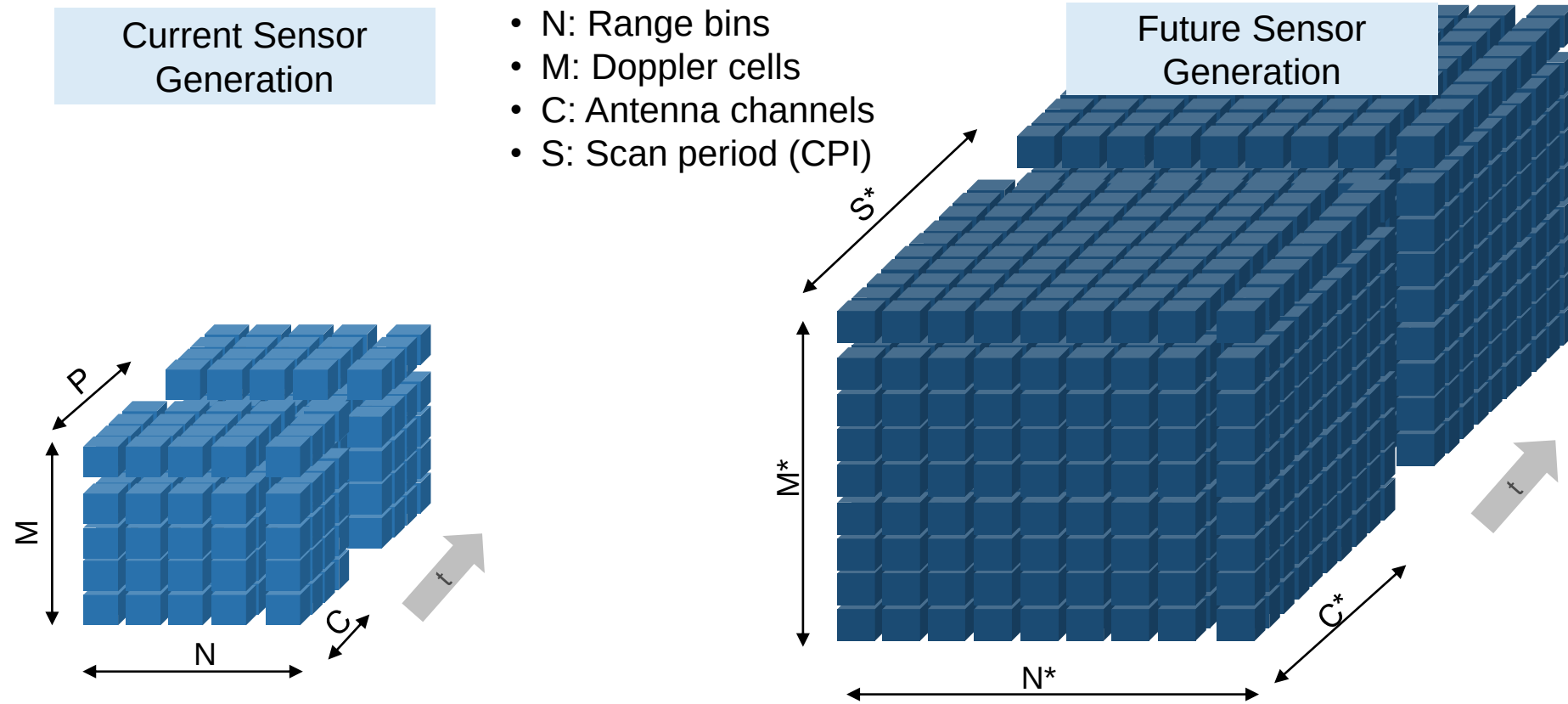
R. WU, M. BRETT

Radar Signal Processing ($r \Rightarrow \dot{r} \Rightarrow \theta$)



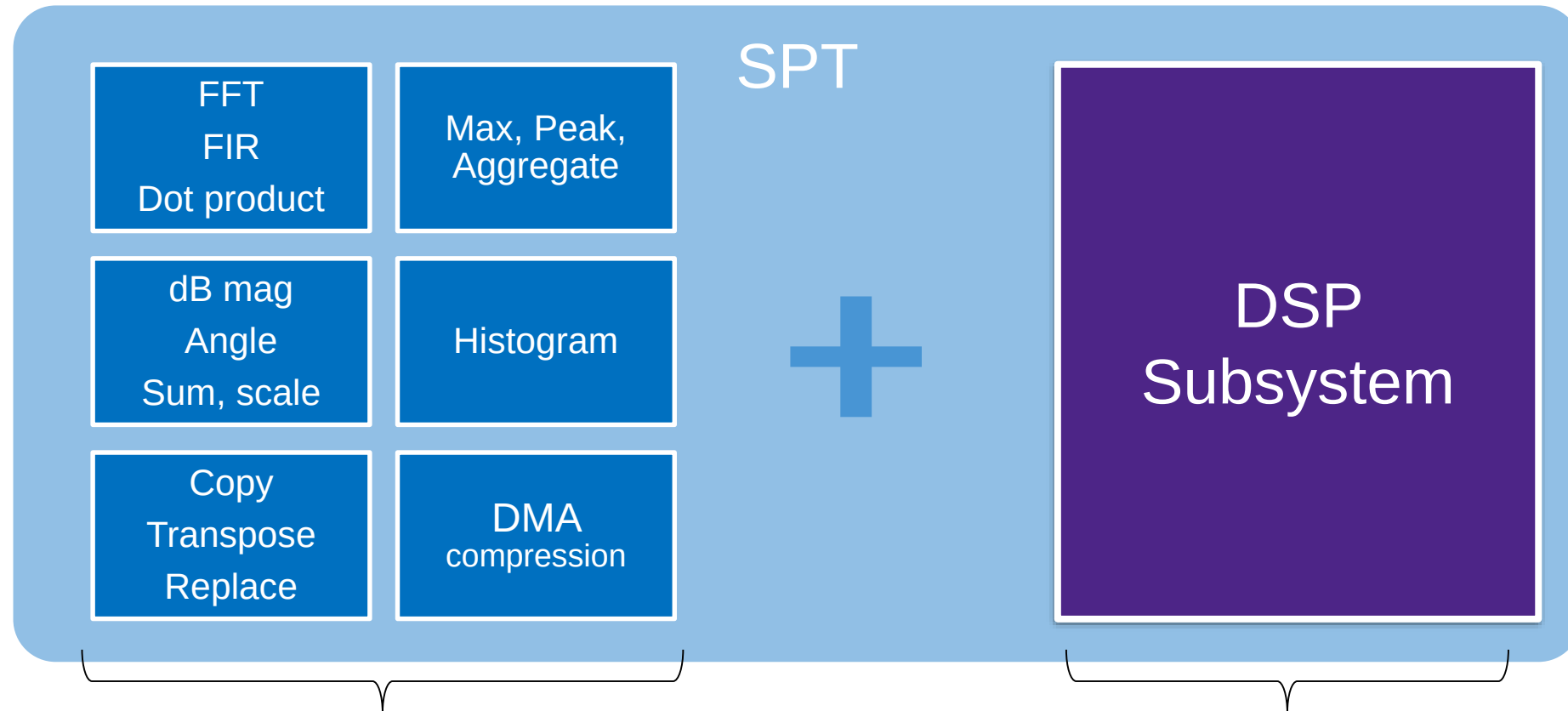
Output:
 $r\text{-}\dot{r}\text{-}\theta_{Hi-Res}$ Map

Strong Increasing Performance Demand



- The computation problem, bandwidths and memory needs scale $\sim N \times M \times C$
- Faster scanning needs extra performance + bandwidth
- More advanced algorithms require additional performance

SPT Capabilities



Accelerated functions for
maximum performance

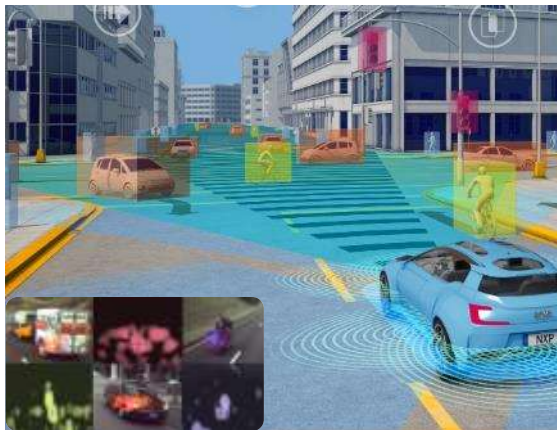
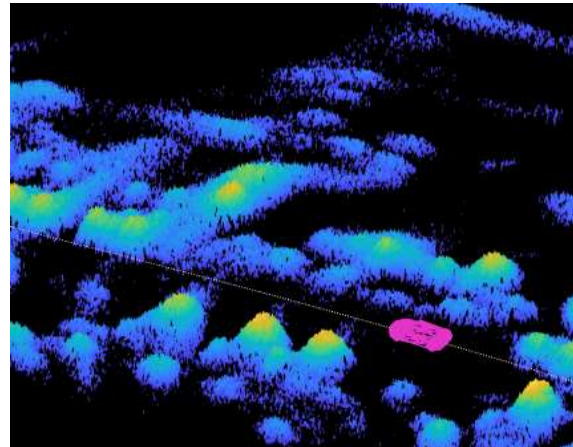
Customer programmable
functions for maximum flexibility

LAX: Acceleration for Environmental Modelling

Detection & Tracking



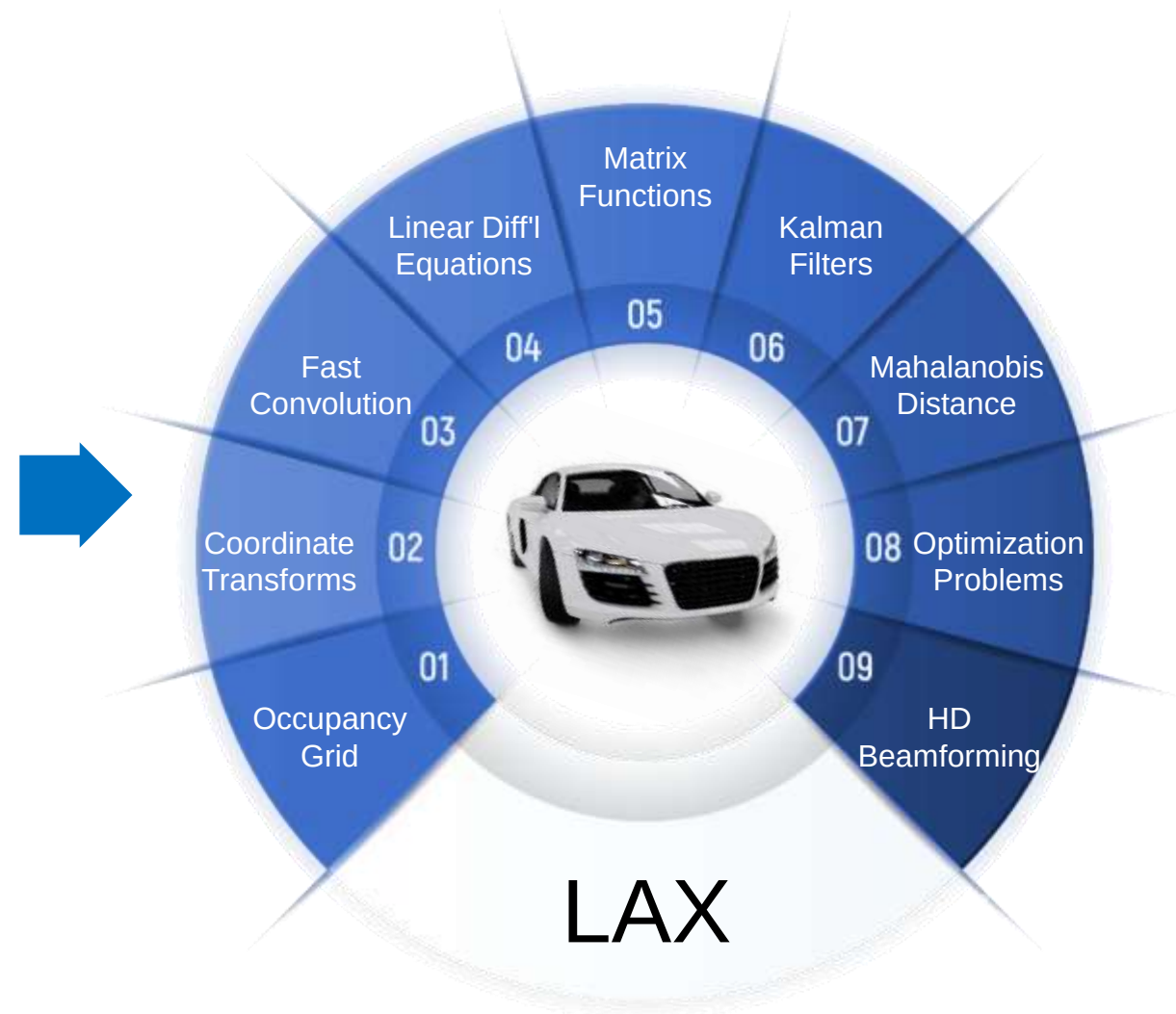
Mapping



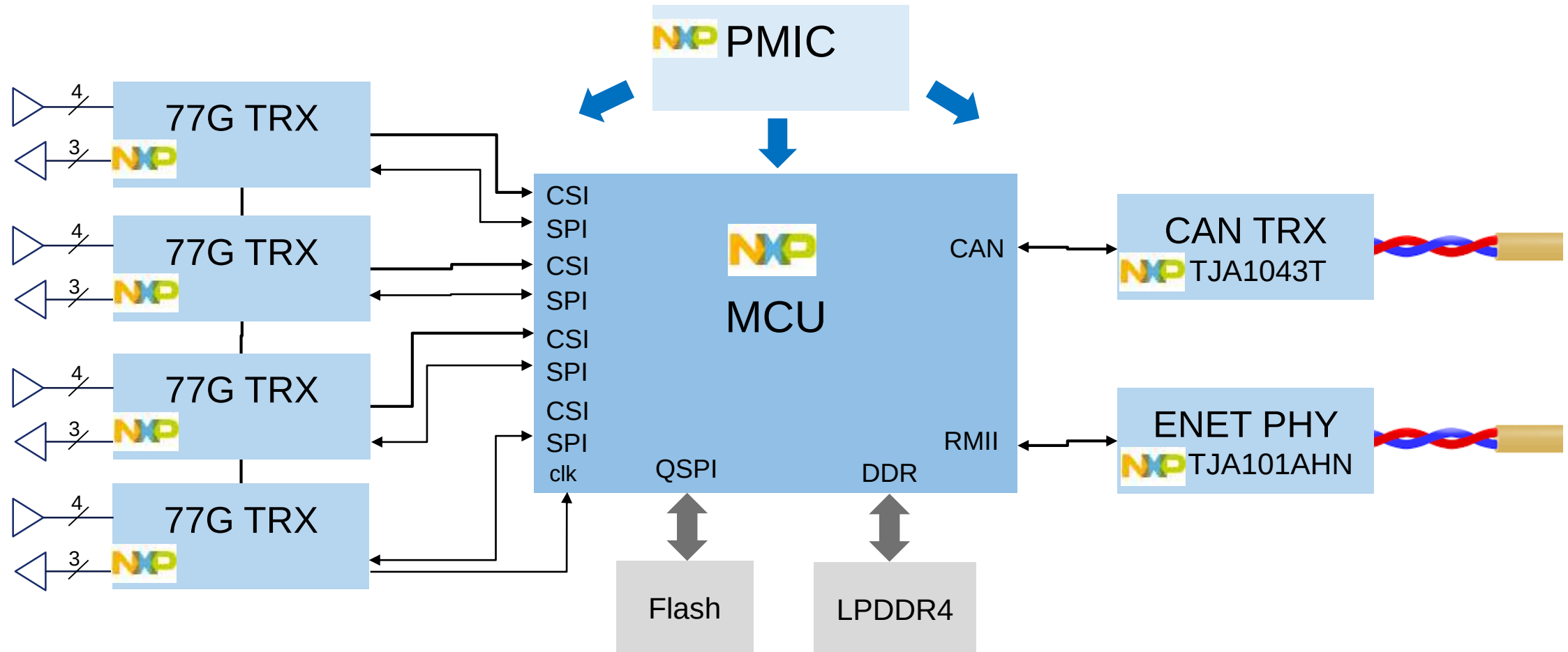
Classification & Segmentation



Localization

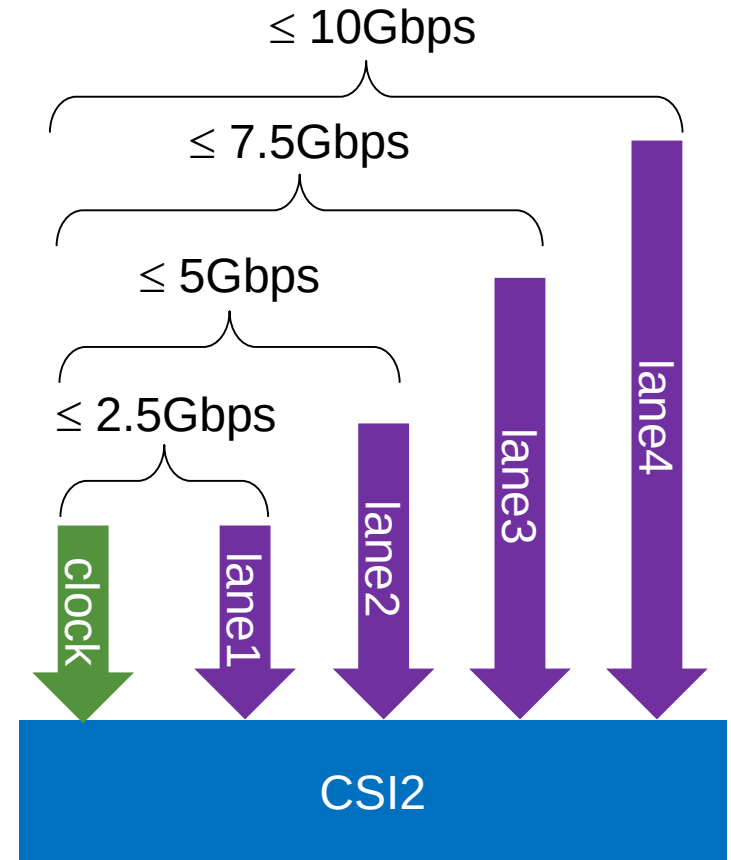


Comprehensive NXP System Solution



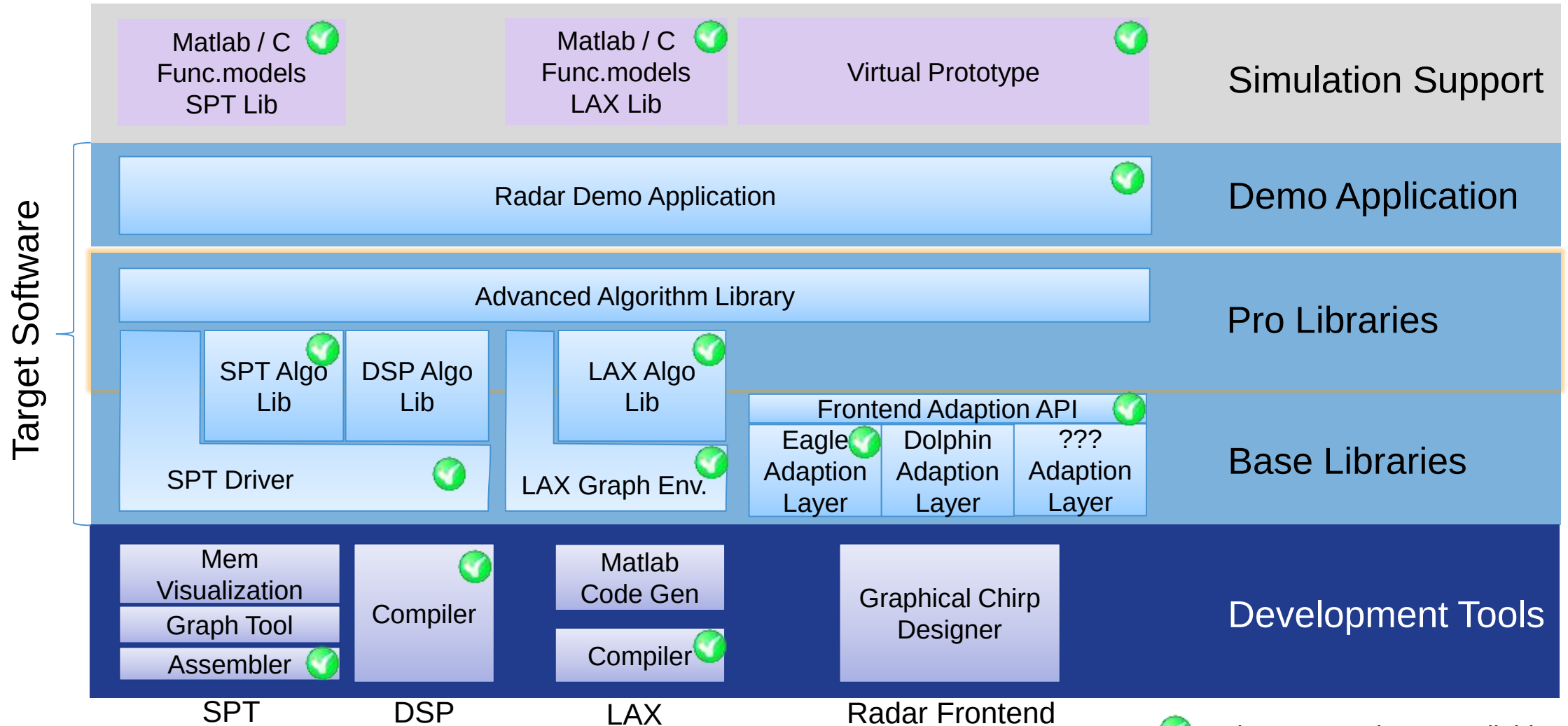
Scalable Use Case with CSI2 Interface

CSI2	4ch x 80MSps 8ch x 40MSps or $vc \times nch \times sr \times 16bit < 10Gbps$			
CSI2	CSI2	8ch x 80MSps 16ch x 40MSps		
CSI2	CSI2	CSI2	12ch x 66MSps 24ch x 33MSps	
CSI2	CSI2	CSI2	CSI2	16ch x 50MSps 32ch x 25MSps
TRX1: 4..8ch TRX2: 4..8ch TRX3: 4..8ch TRX4: 4..8ch				



Excellent scalability: sample rate/ number of channels/ ADC bit-width/ number of lanes/ clock rate

Radar SDK



Early-access release available

Outlook

Neural Net
Augmented
RADAR
Processing



New MIMO
Waveform
FCM+



Hi-Res.
Angle
Processing



Interference
Mitigation/
Avoidance



Next Generation RADAR Sensor
Sub-degree resolution, independent perception, high robustness



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