ANALOG DEVICES

SOFTWARE-DEFINED RADIO (SDR) ON A CHIP: FROM ETHERNET TO RF WITH AN INTEGRATED PROCESSOR SUBSYSTEM

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Six Generations of ADI Integrated Transceivers 2010-2025

AD9371, 100MHz
2Tx/2Rx, DPD

First SDR to enable
3G/4G Macro Cell radios

ADRV9029, 200MHz
4Tx/4Rx, CFR / DPD

First SDR to enable
5G massive MIMO radios

ADRV9060 4Tx/4Rx, 400MHz
O-RAN eCPRI and LowPhy
Channelizers, CFR / DPD

First SDR to enable
5G massive MIMO radios

2010 — More Channels, More Bandwidth, More Functionality, Less Power and Cost per Channel — **2025**

AD9361
2Tx/2Rx, 60MHz

First General Purpose SDR

ADRV9009
2Tx/2Rx, 200MHz

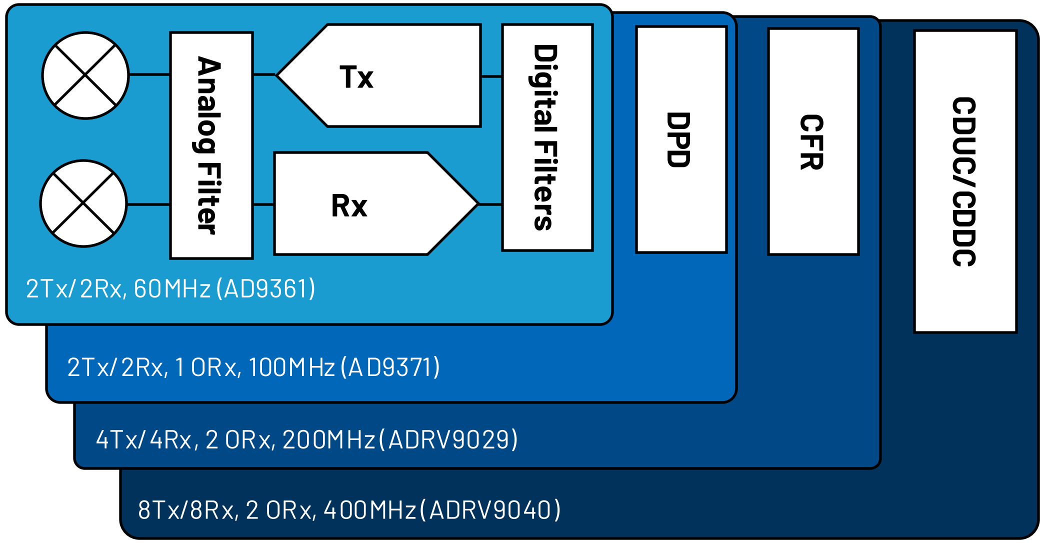
First SDR to meet the stringent
Multi-carrier GSM requirements

ADRV9040 8Tx/8Rx, 400MHz
Channelizers, CFR / DPD

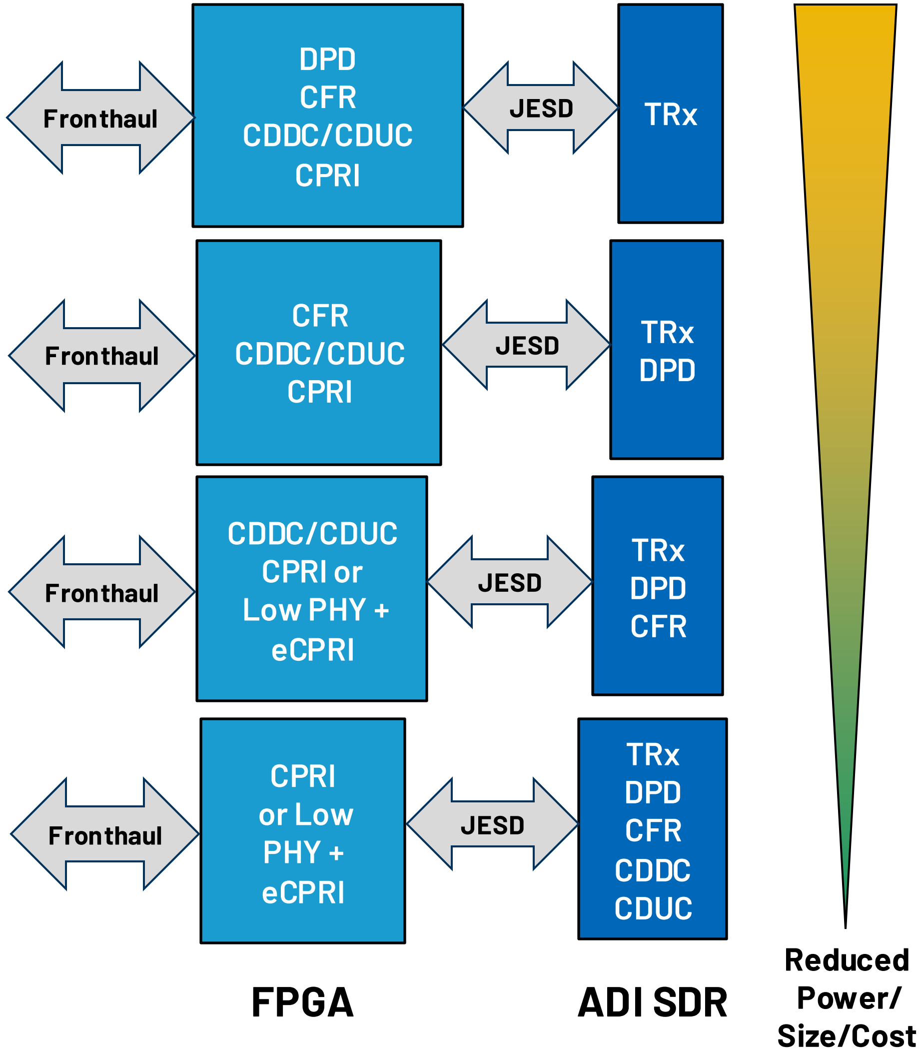
First 8 channel, 400MHz SDR
with complete DFE functionality

More Digital Functionality Absorbed in ADI SDRs Over Generations

But an FPGA was always needed to make a complete radio unit



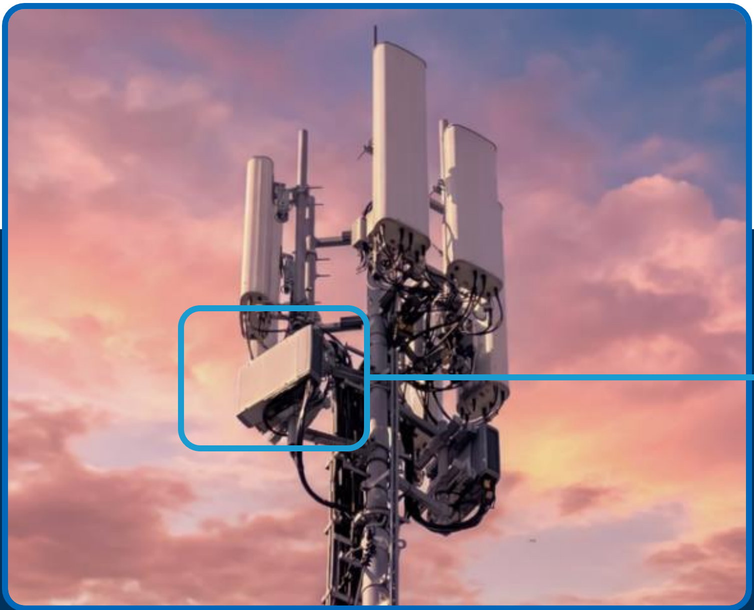
- **DPD**: digital predistortion
- **CFR**: crest factor reduction
- **CDUC**: channel digital upconverter
- **CDDC**: channel digital downconverter
- **CPRI**: common public radio interface (time domain IQ samples)
- **eCPRI**: enhanced common public radio interface (frequency domain IQ samples)



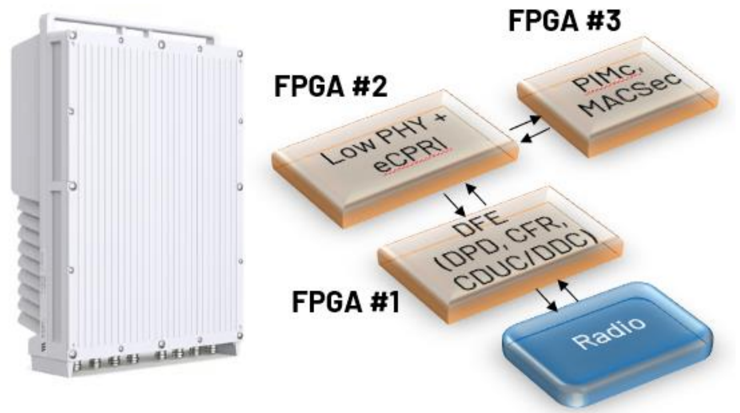
ADRV906x (Samana)

Full-featured radio on a chip—no FPGAs

4G/5G Macro Radio Unit



Implementation with FPGAs



Samana

Radio on a chip

Total Power 15W*

Application Requirements

Small and lightweight

Low power

Cost optimized

Challenges with FPGAs

FPGAs drive **high cost and power** (>50W)

Power drives **weight**

High IP integration effort for customers

Samana Provides

Low-power consumption RU SoC (**15W***)

Full system integration into single IC

Up to **30% BOM cost savings** by eliminating FPGAs

*15W is for TDD 4Tx/4Rx, 200MHz Carrier BW and 70/30 DL/UL ratio

Radio Access Network (RAN) Building Blocks and Partitioning

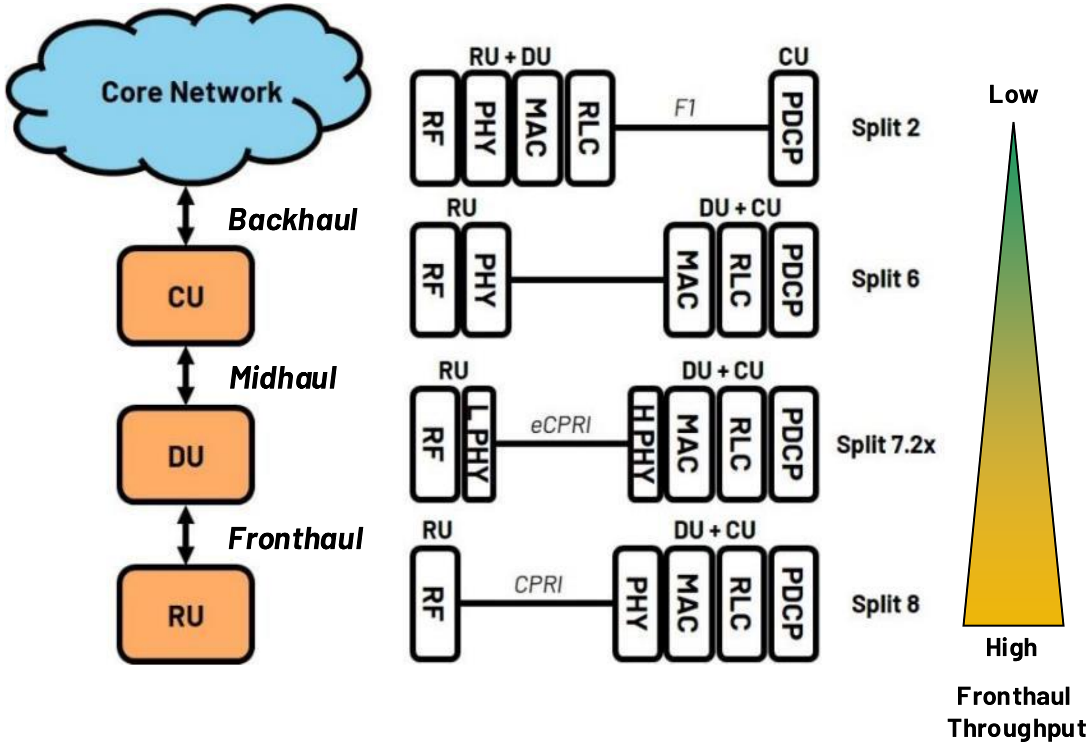
RAN Architecture
Three blocks: **RU** (radio unit), **DU** (distributed unit), **CU** (central unit).

Split Trade-Off
Higher splits → more fronthaul throughput and tighter latency.

4G/LTE (Split-8)
Time-domain I/Q samples sent via CPRI protocol to the baseband unit (DU + CU). A single 20MHz carrier in 4Tx/4Rx configuration needs 5Gbps.

5G Macro/Massive MIMO (Split 7.2x)
Split-8 impractical for wider channel BW and more Tx/Rx chains in 5G. By moving the low-PHY processing from DU to RU, the fronthaul throughput is significantly reduced.
In Split 7.2x, frequency domain I/Q samples are transferred via eCPRI protocol between the DU and RU.

All-in-One Small Cell Radios (Split 6)
For a self-contained small cell with limited coverage and capacity, it may make sense to put RU and DU in the same box.



- **PDCP** (packet data convergence protocol)
- **RLC** (radio link control)
- **MAC** (media access control)
- **PHY** (physical layer)

Formation of the Open Radio Access Network (O-RAN)

Mission: transformation of the RAN into an open, intelligent, and virtualized system

O-RAN ALLIANCE

Over 300 Members

32 Mobile Network Operators

Over 147 Unique Technical Titles

Supply Chain Diversity
Open and interoperable interfaces enable RU, DU, and CU purchase from best-in-class vendors

Increased Innovation
Separate hardware and software enable large community of innovators

Lower Costs
RAN virtualization (mainly in DU and CU) enables use of COTS servers, similar to data centers

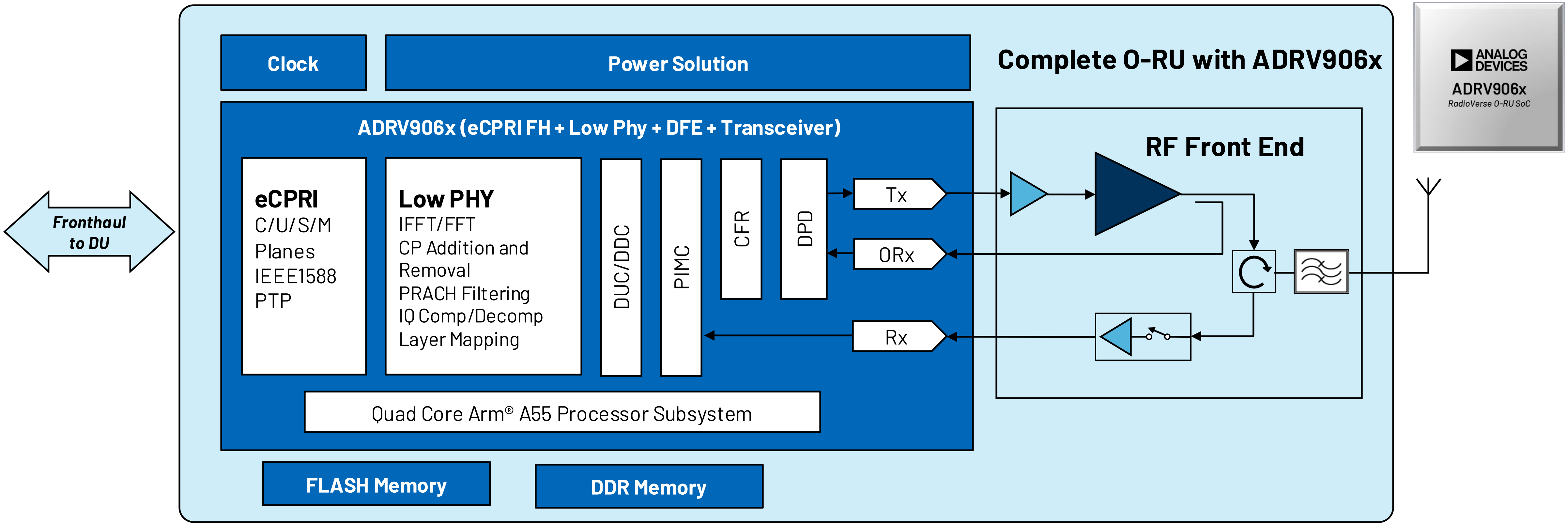
Introduction to O-RAN Open Fronthaul Interface

ADRV906x (Samana) integrates an eCPRI fronthaul interface compliant with O-RAN split 7.2a standard

- **eCPRI**: enhanced common public radio interface—standard Ethernet-based protocol for transferring data and control signals between RU and DU. The O-RAN open fronthaul interface complies with eCPRI and further specifies:
- **User Plane (U-Plane)**: messages containing frequency domain I/Q data samples that are transmitted or received.
- **Control Plane (C-Plane)**: real-time control information regarding handling of user plane data such as how to map the IQ samples to each antenna port.
- **Synchronization Plane (S-Plane)**: precision time protocol (PTP) messages based on IEEE 1588 to synchronize the RU to the rest of the network.
- **Management Plane (M-Plane)**: slow control and **radio configuration** information **(USE CASE CONFIG).**

Radio on a Chip

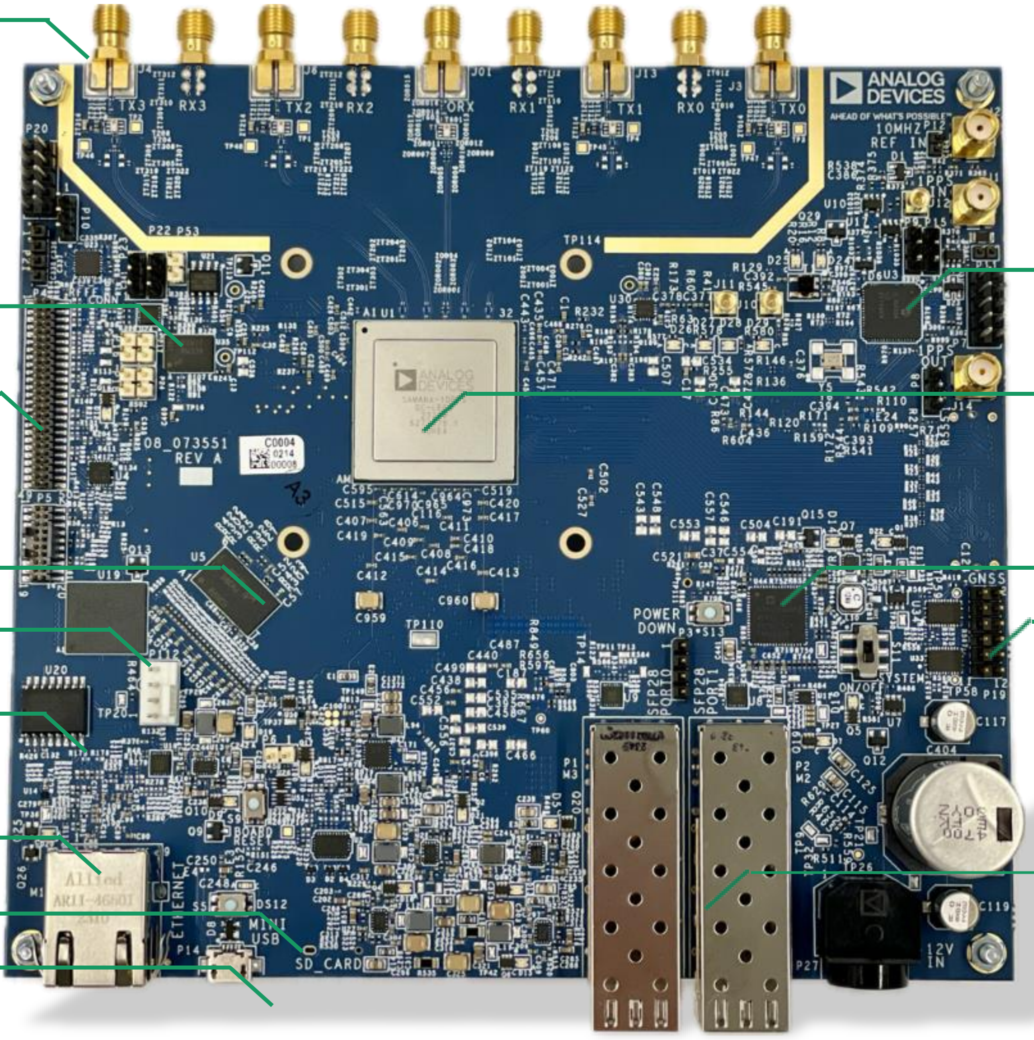
Fronthaul to RF with ADRV906x (Samana)



O-RAN Split 7.2a compliant radio on a chip. **Only RFFE, power, and clocking are external to ADRV906x!**

[ADRV906x (Samana): The Most Integrated SDR Platform for 4G/5G Networks]

Complete Radio Board Design with Samana



Thank You for Your Attention!

More In-Depth Workshop Focused on ADRV906x (Samana):

Session number
IWWe4

Session title
Keeping up with the Wireless G's: Role of Software Defined Radios and Standard Interfaces

Date
6/10/2026 (today)
10:10 AM to 11:50 AM

Room 154

ADRV906x (Samana) Machine Learning-Based DPD Demo at ADI Booth:

AI-Enhanced Radio Efficiency at the Physical Edge

AHEAD OF WHAT'S POSSIBLE

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