

5G Research and Technological Trends

A collage of images on the right side of the slide. It includes a person in a white lab coat talking on a mobile phone, a blurred city skyline at night, a close-up of a circuit board, and a view of a cloudy sky.

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5G Research & Technological Trends Summary

5G NR Foundation

- Massive MIMO
- mmWave
- Spectrum Sharing

Cloud RAN

- Open Interfaces
- Open Hardware
- Network Edge

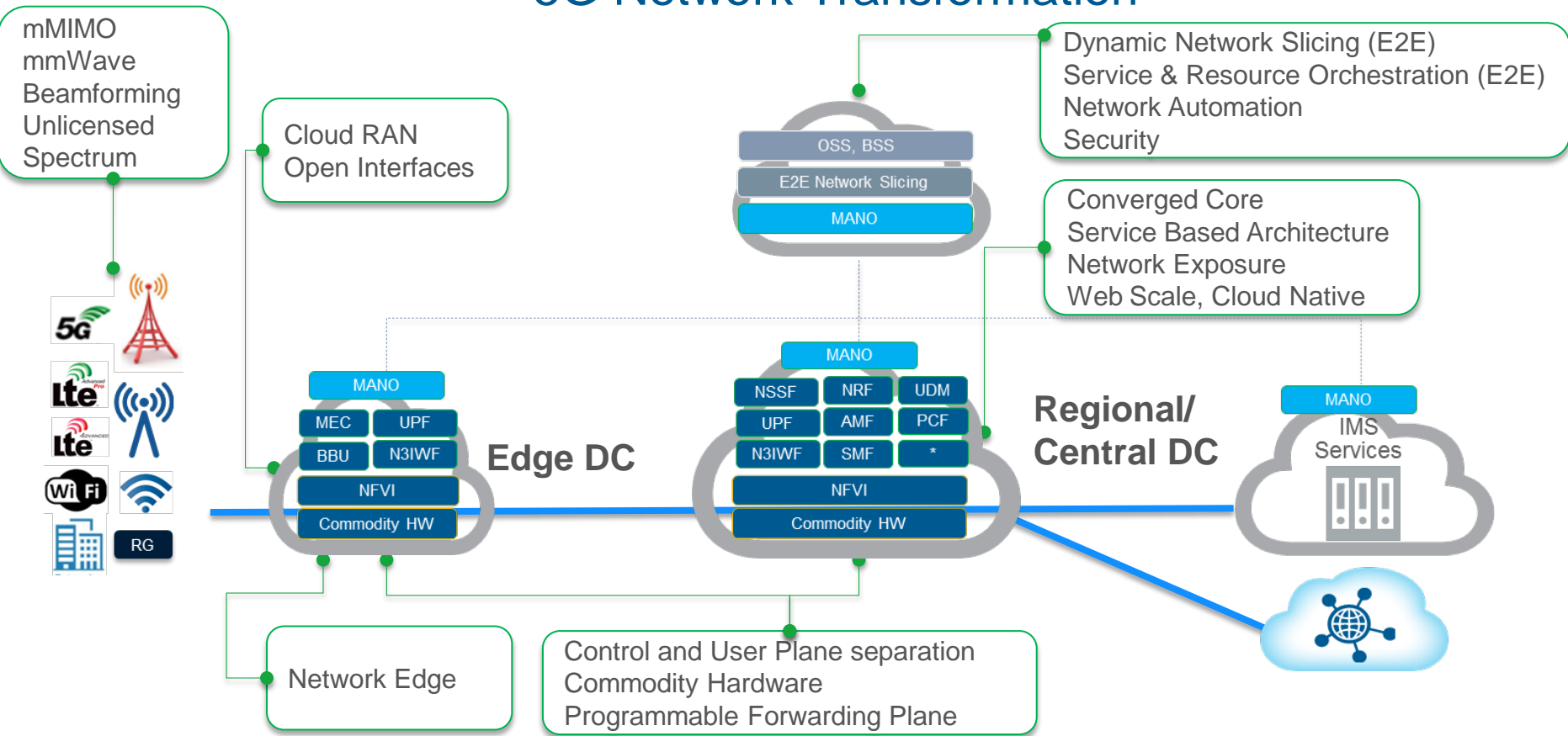
Flexible Network Architecture

- Cloud Native
- Network Slicing
- Disaggregated NFs
- Open Source
- Commodity Servers
- Network Exposure

Agile Network

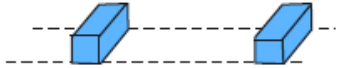
- NFV
- SDN
- Distributed Cloud
- Analytics
- Automation
- Security

5G Network Transformation



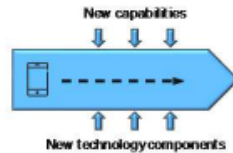
5G NR – Air Interface enhancements

Ultra-lean

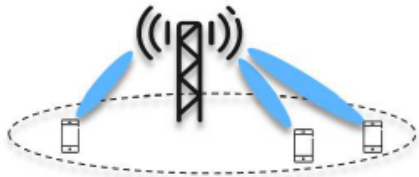


Need-based reference signals,
Reduce always-on signals

Forward compatibility

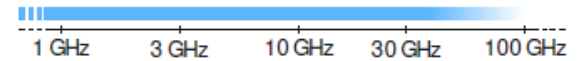


Multi-antenna



Enhanced spatial re-use
with large planar arrays

Wide spectrum range



Hybrid beam-forming
technologies to support
mmWave Operation

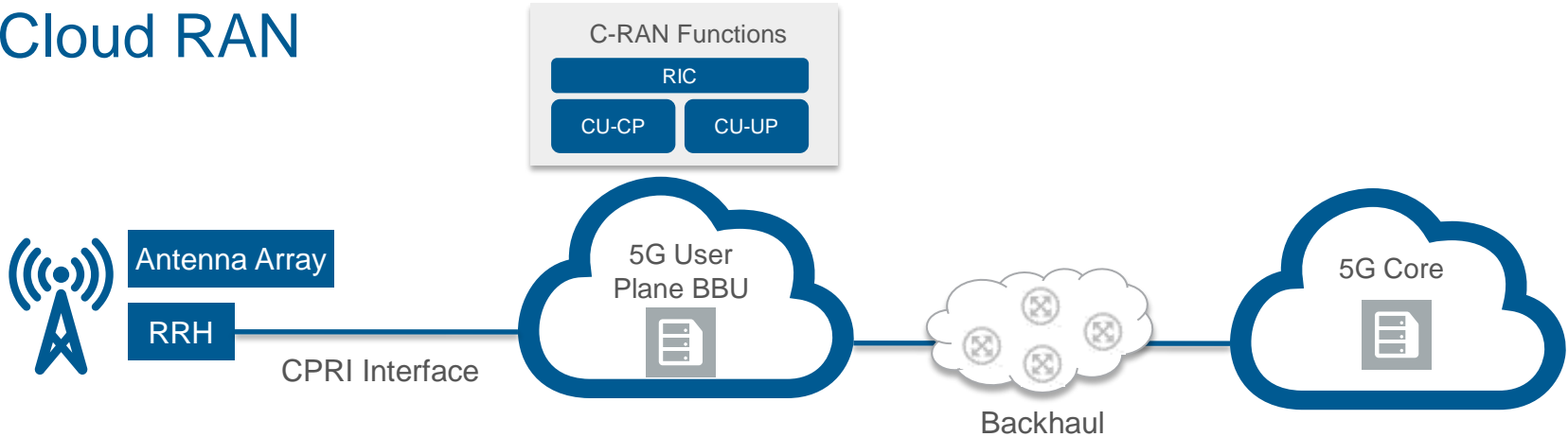
Low latency



Short TTIs, ACK/NACK
in same slot.

Image re-used from Workshop on 3GPP submission towards IMT-2020, Brussels, Oct. 24-25, 2018

Cloud RAN



Industry Momentum

- Open, standardized interfaces (CPRI) for a disaggregated RAN
- Ethernet based Front haul
- Multiple Split Options
- Commodity hardware

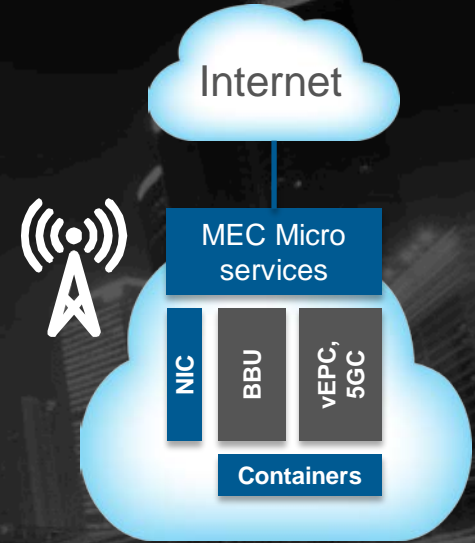
Multiple Initiatives

- Telecom Infra Project (Facebook) TIP
- xRAN and C-RAN merger to ORAN Alliance
- Cisco “Open vRAN Ecosystem”
- OpenRAN – TIP
- Mavenir “Open RAN Ecosystem”

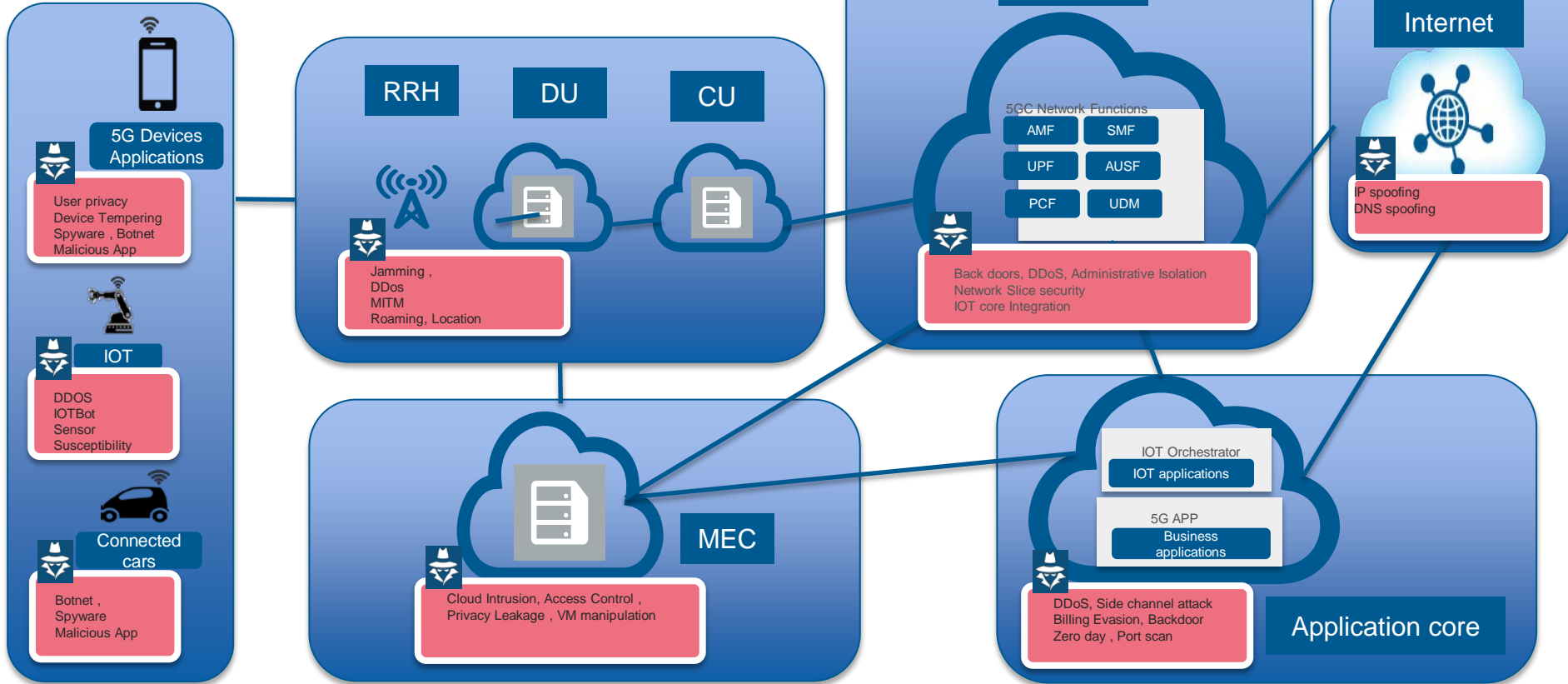
Packet Core moving to the Edge

- Deliver low latency services (AR, VR etc.)
- Reduce Cost (e.g. Caching)
- Improve customer experience (video caching)
- Split Control and User Plane
- Private IoT networks
- Combined Cloud RAN and vEPC/5GC functionality

Requires a small footprint ... vEPC/5GC that can Scale



Security Threat Landscape



5G Security

Resiliency

- Split Architecture (RAN)
 - CU –Secure Sensitive functions
 - DU - non-Secure functions
- Slice based security implementation
- Service Base architecture

Communication Security

1. End to End encryption
2. Automatic recovery from malicious security algorithm mismatches
3. Security key separation between core network functions
4. Fast synchronization of security contexts in access and core networks

Identity Management

- Enhance credential types
- SIM/e-SIM
 - Certificates
 - Pre-shared keys
 - Security Token

Privacy

- Stricter policy for update of temporary identifiers
- Mutual Authentication
- Integrity protection and encryption both signaling and data

End to End Network Slicing

Verticals MVNOs

Slice Request Attributes:
 Service Type, Latency, Throughput, Reliability,
 Mobility, Geography, Security, Analytics

E2E Network Slice Design

E2E Network Slice Instances

RAN Network Slice Subnets Transport Slice Subnets Core Network Slice Subnets Service Network Slice Subnets

5G Applications

RRH

C-RAN Functions

CU-CP CU-UP

5G User Plane BBU

BackHaul

5GC Network Functions

AMF SMF

UPF AUSF

PCF UDM

5G Core

IMS Network Functions

REG MMTTEL

RMS SCC

SBC WRG

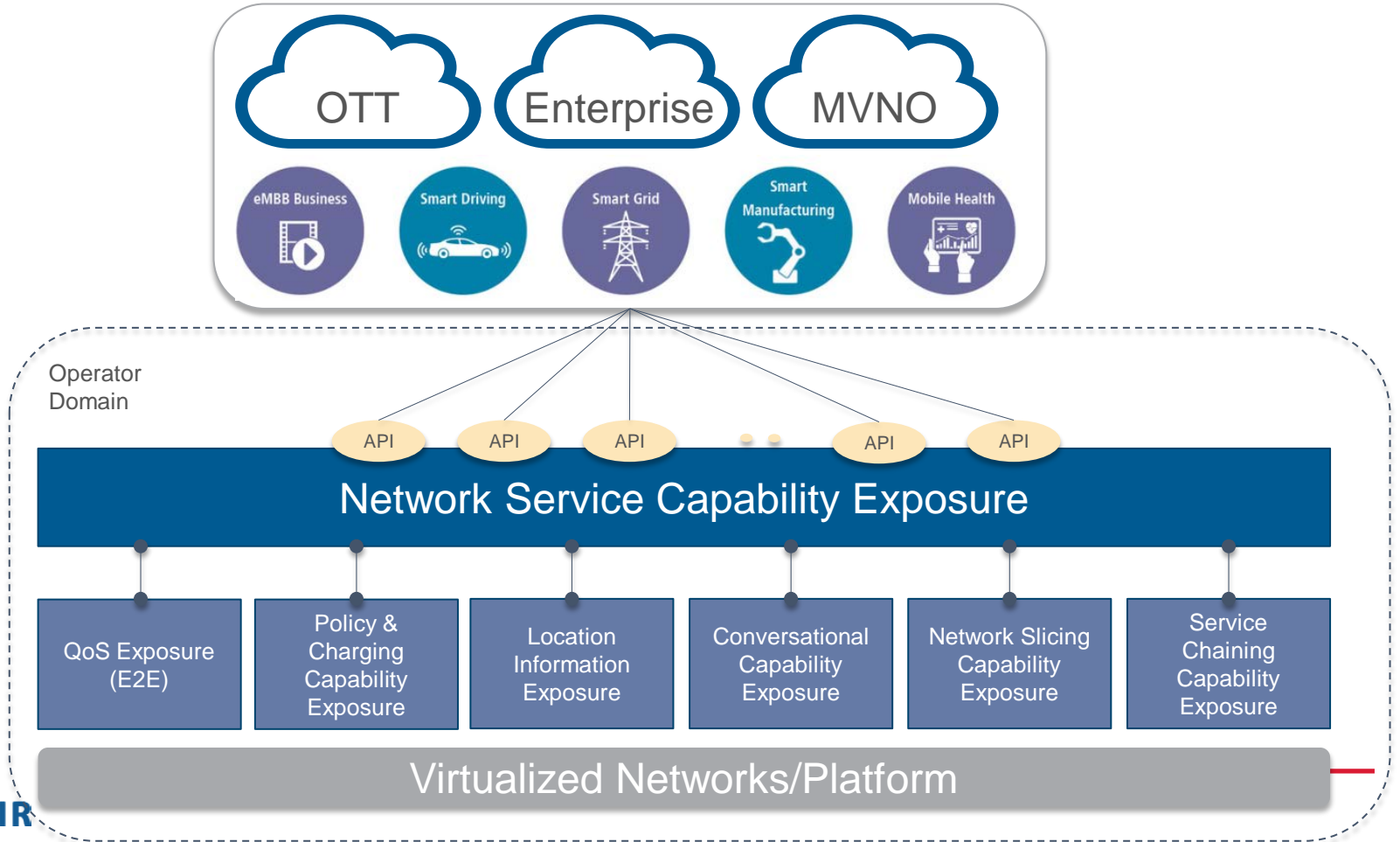
IMS Services

E2E Virtual Network Tailored and Optimized for specific Tenant

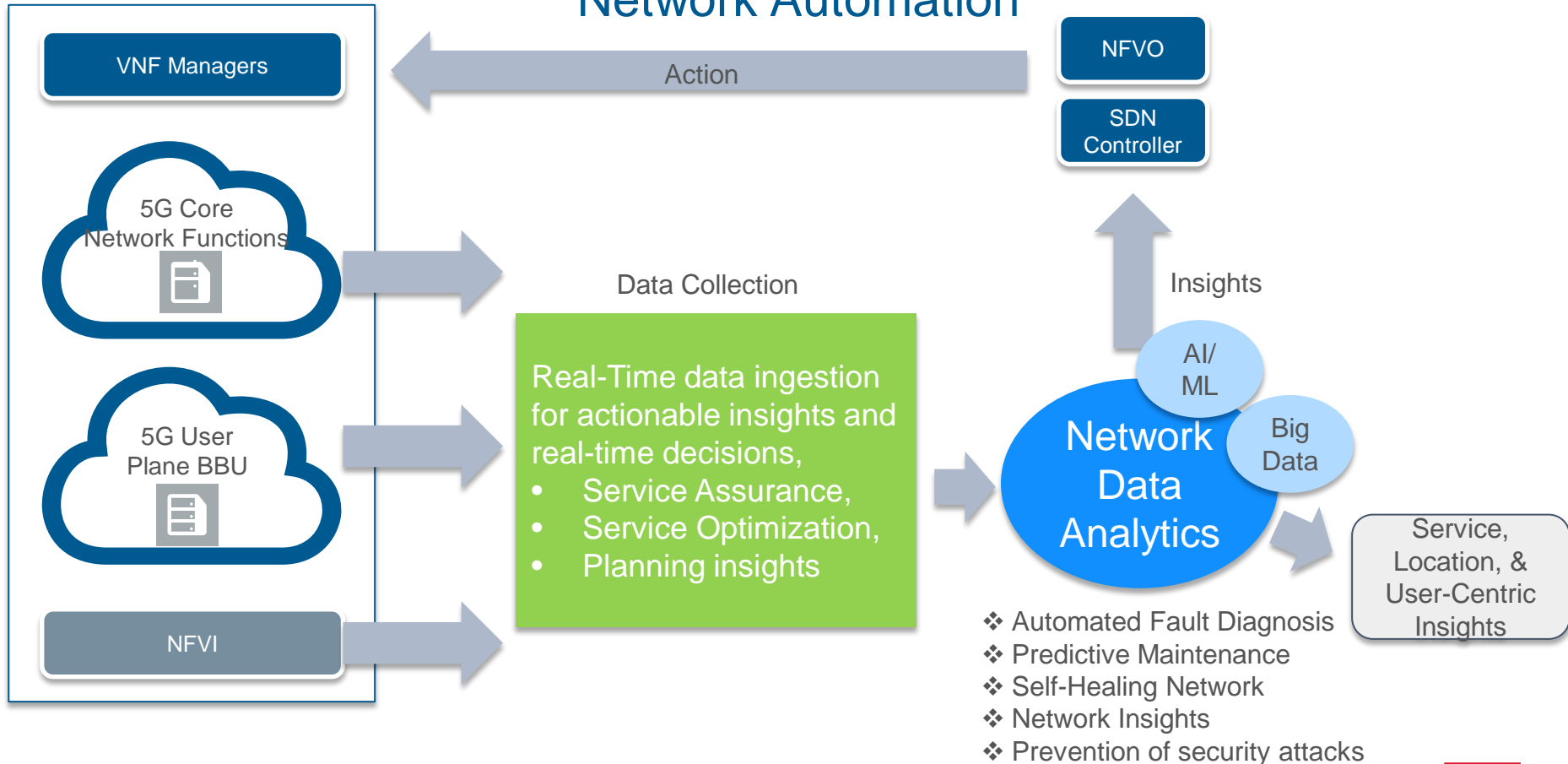
External Network

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Network Service Capability Exposure



Network Automation



THANK YOU