Architettura 5G SA per Moni5G

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Linkem in a nutshell

Founded in 2001

Fixed Wireless Access (FWA) operator using 3GPP standards-based wireless technology

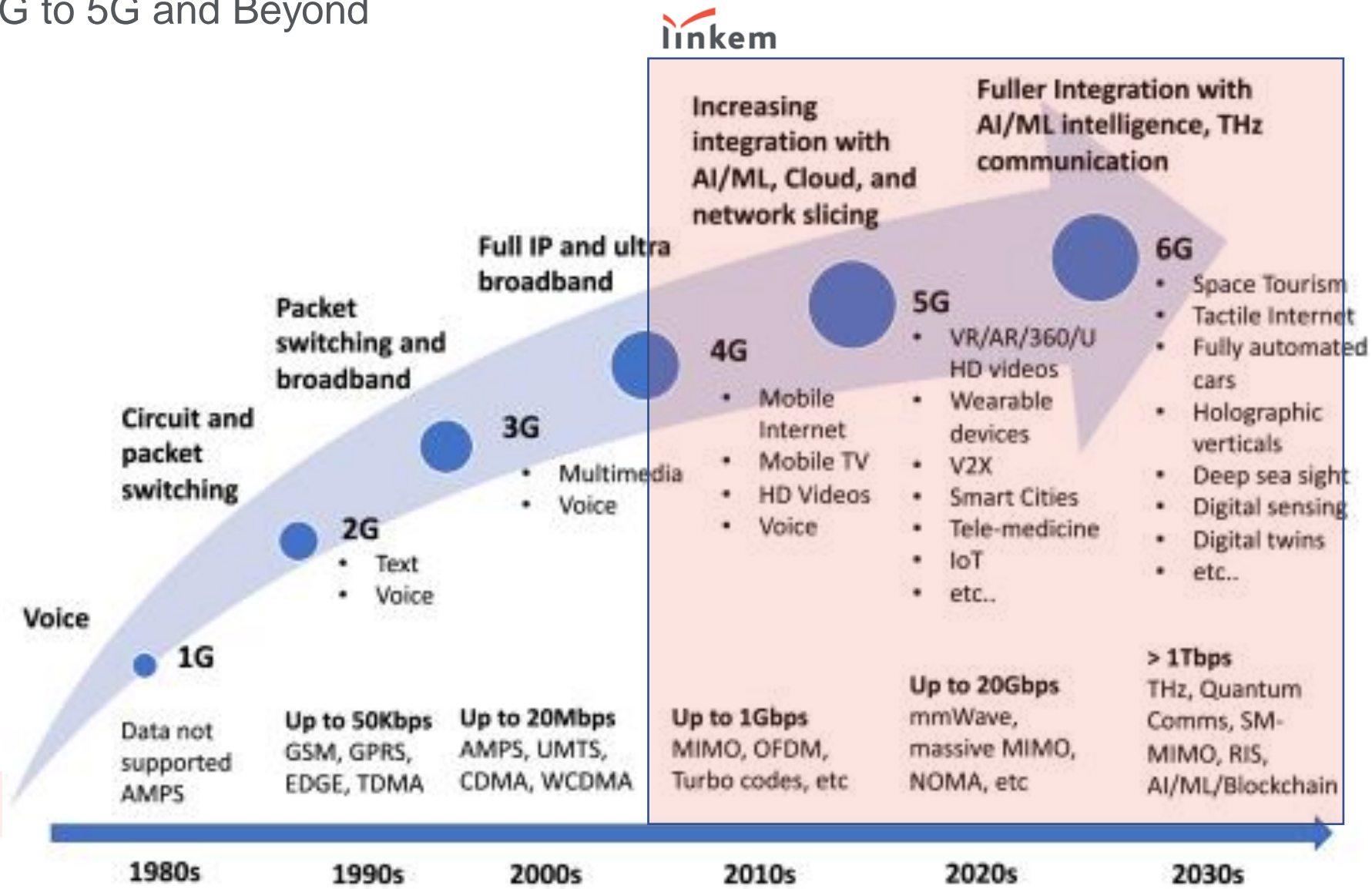Proprietary network covering about 70% of the national population

Licensed 5G spectrum in the 3,4GHz-3,6Ghz

First 5G Stand Alone commercial solution in the Italian Market

# Roadmap 3GPP and Linkem Adoption

From 1G to 5G and Beyond

Source: Optical Publishing Group

5G is keeping its promises

Theoretical Peak THP	DL	UL
5G @60MHz	925	106
5G @40MHz	595	70
LTE @2x20MHz	280	13

5G theoretical gain in DL/UL is directly correlated to the increase of spectral efficiency given by the new technology

$$Spectral\ Efficiency = \frac{Traffic\ Volume}{Occupied\ Bandwidth\ Resources}$$
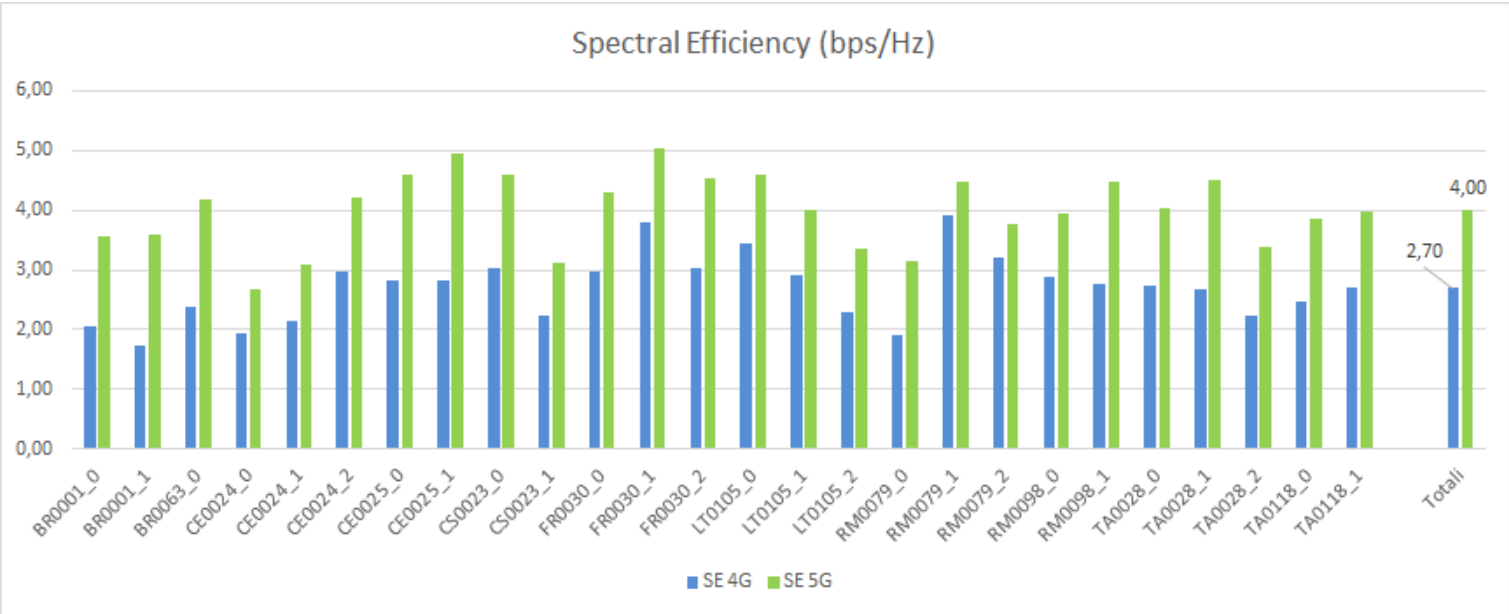
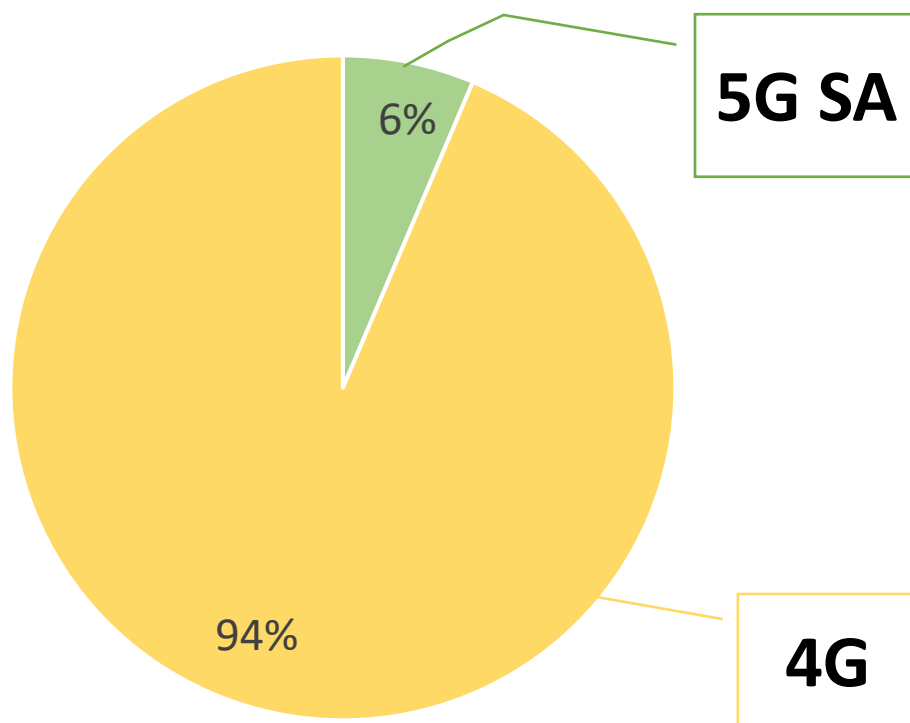Benchmark between spectral efficiency results on some typical production nodes migrated from 4G to 5G

+ 48%

Spectral Efficiency (bps/Hz)
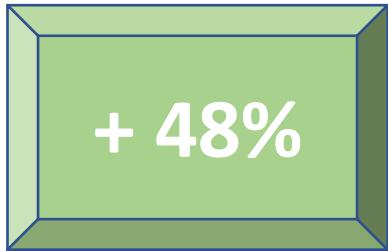
Our 5G production experience .. until now

Traffic mix

6% **5G SA**

94% **4G**

Coverage

% 5G households

	15,7%	17,1%	25,3%
	ACTUAL	3Q 2022	4Q 2022
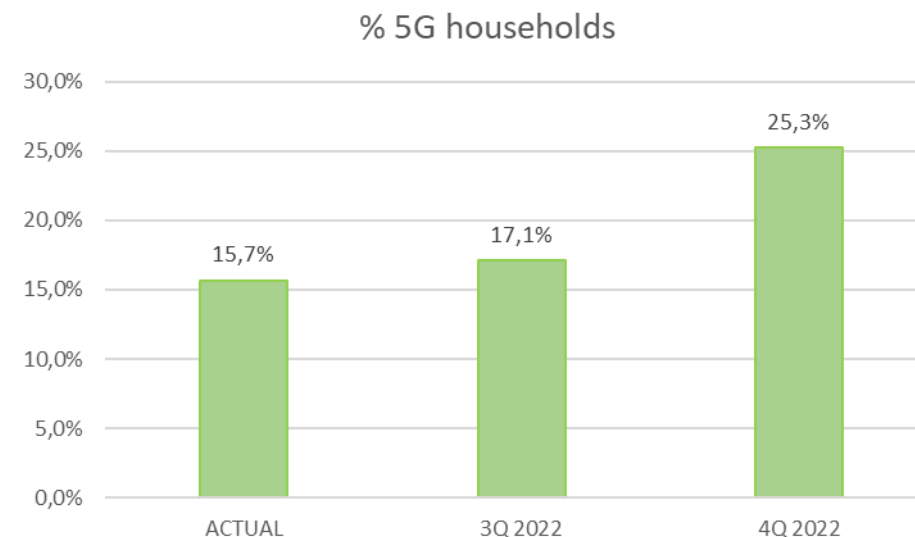
Average capacity increase for 5G FWA subscribers

20%

Moni5G Roadmap

2019

5G Preparation
5G Core Tender
5G/4G dual mode CPE Tender

5G Readiness
RAN upgrade with 5G ready equipment

2020

Moni5G Access Network Cluster

RAN cluster upgrade with 5G ready equipment

Fiber optic backhauling deployment by Tiscali

Housing set-up in Tiscali's POP

Backbone links delivery from this POP to Linkem's data centers in Rome

2021

5G SA Core Network go live

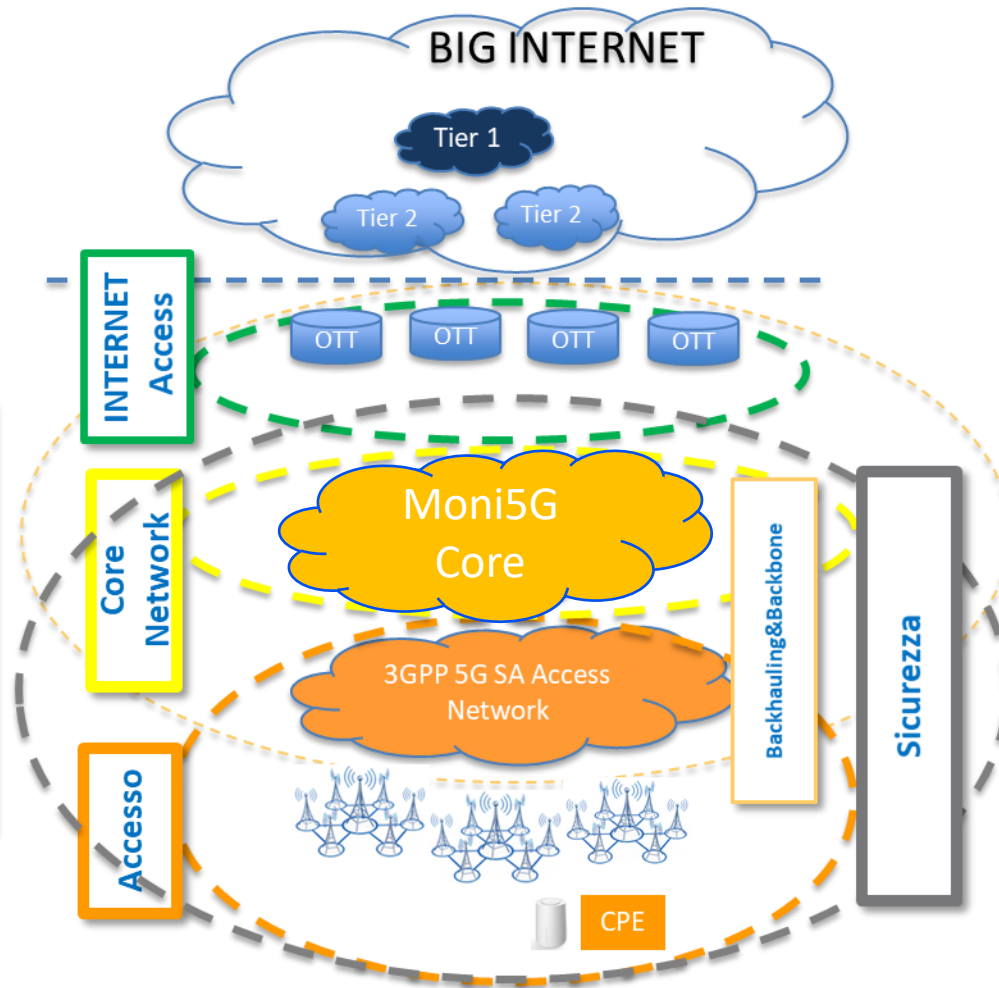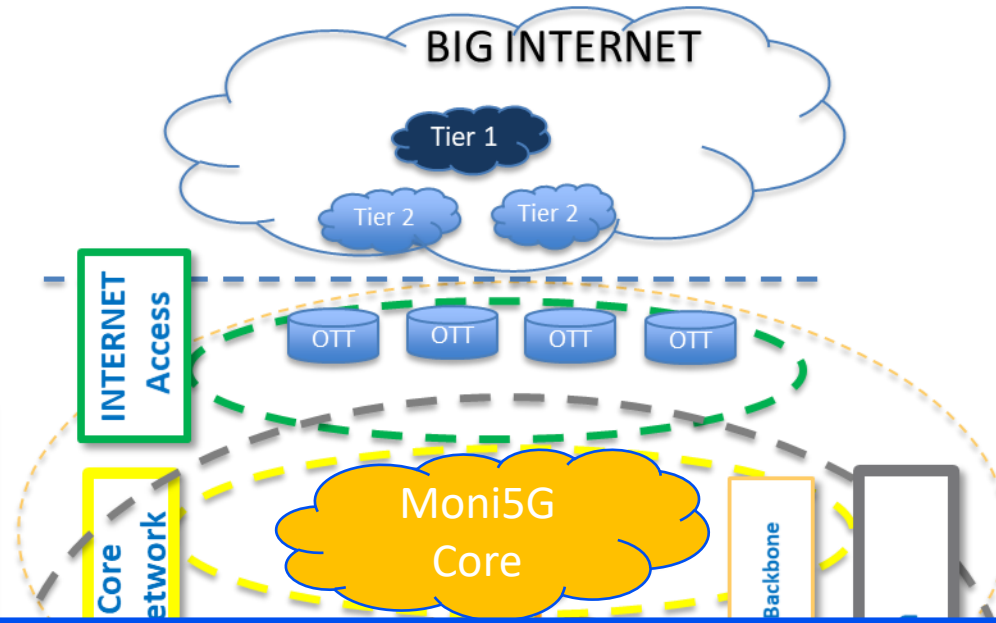## Moni5G Use Cases

2022

CPE

- Vendor: Gemtek
- Standard: 3GPP Rel. 15
- 5G Sub6GHz (3.5GHz)
  - SA (Standalone) Option 2
  - TDD Banda n78
  - 2Tx & 4Rx (RF front end)
  - Downlink: 1CC Max BW 100MHz; 4x4 MIMO; 256QAM
  - Uplink: 1CC Max BW 100MHz; 2x2 MIMO; 256QAM
  - Dual DNN
  - TR-069 /HTTPS for remote control

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Moni5G

3GPP 5G SA Architecture

BIG INTERNET

Tier 1
Tier 2   Tier 2

INTERNET Access

OTT OTT OTT OTT

Linkem Ecosistema

Core Network

Moni5G Core

Backhauling&Backbone

Sicurezza

3GPP 5G SA Access Network

Accesso

CPE

RAN

- Vendor: Huawei
- Standard: 3GPP Rel. 15
- SW: SRAN16.1, including LTE eRAN16.1 and 5G RAN 3.1 (5G NR 3GPP rel15)
- Spectrum: 20/40 MHz dedicated to the project

SecGW

- Vendor: Fortinet
- SecGW and SCTP Firewall for user plane and control plane security from RAN to the core network

Moni5G

3GPP 5G SA Architecture

BIG INTERNET

Tier 1

Tier 2   Tier 2

INTERNET Access

OTT   OTT   OTT   OTT

Linkem Ecosistema

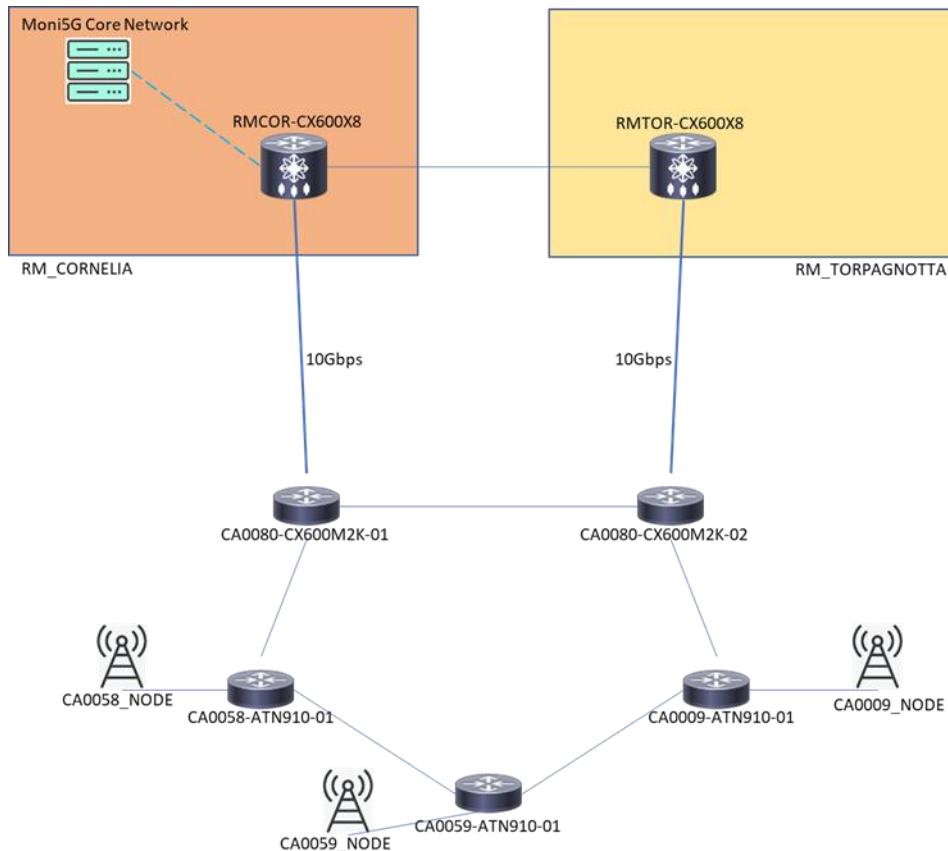Core Network

Moni5G Core

Backbone

The Core Network is hosted on an infrastructure based on the ETSI Network Functions Virtualization standard: non-specialized hardware resources managed by an open standard cloud computing platform optimized for Telco applications.
The Network Functions of the Core Network 5G are Cloud Native applications, based on microservices orchestrated by Kubernetes
(container orchestration system)

Moni5G Core Network

- Vendor: Ericsson
- Standard: 3GPP Rel.16
- Network functions:
  - ➢ AMF – Access Management Function for customers authentication
  - ➢ SMF – Session Management Function for traffic sessions management and interaction with the Radius Server for traffic accounting
  - ➢ UPF – User Plane Function for customers traffic delivery
  - ➢ UDM – User Data Management for customer profile database
  - ➢ AUSF – Authentication Service Function for criptograghy keys management
  - ➢ NRF – Network Repository Function which guarantees HTTP/2 interworking between internal nodes of the core network
- Configured traffic DNN (Data Network Name): "MONI5"
- Profile: 1Gbs/100Mbps

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Moni5G

Fiber optic backauling & backbone provided by **// TISCALI**

linkem

Backbone
- 10Gbs DWDM Links from Tiscali's PoP to Linkem's data centers (fully diversified paths)
- Traffic routing to Moni5G core network installed in Linkem's data center of Roma Cornelia

Backhauling
- Fiber optic backahuling delivered on Tiscali's MAN
- Ring topology created for traffic collection

(*) The Guspini site remained outside this ring (microwave used for this backhauling service)

Moni5G has been a valuable training ground for what is the great challenge of 5G:

integration of sensing, processing, communication and cloud technologies