Evolution or Revolution

Cloud, AI, and new spectrum in the 5G/6G era and the role of open source in the innovation pipeline

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150 YEARS OF CONNECTING AT&T


150
YEARS OF
CONNECTING
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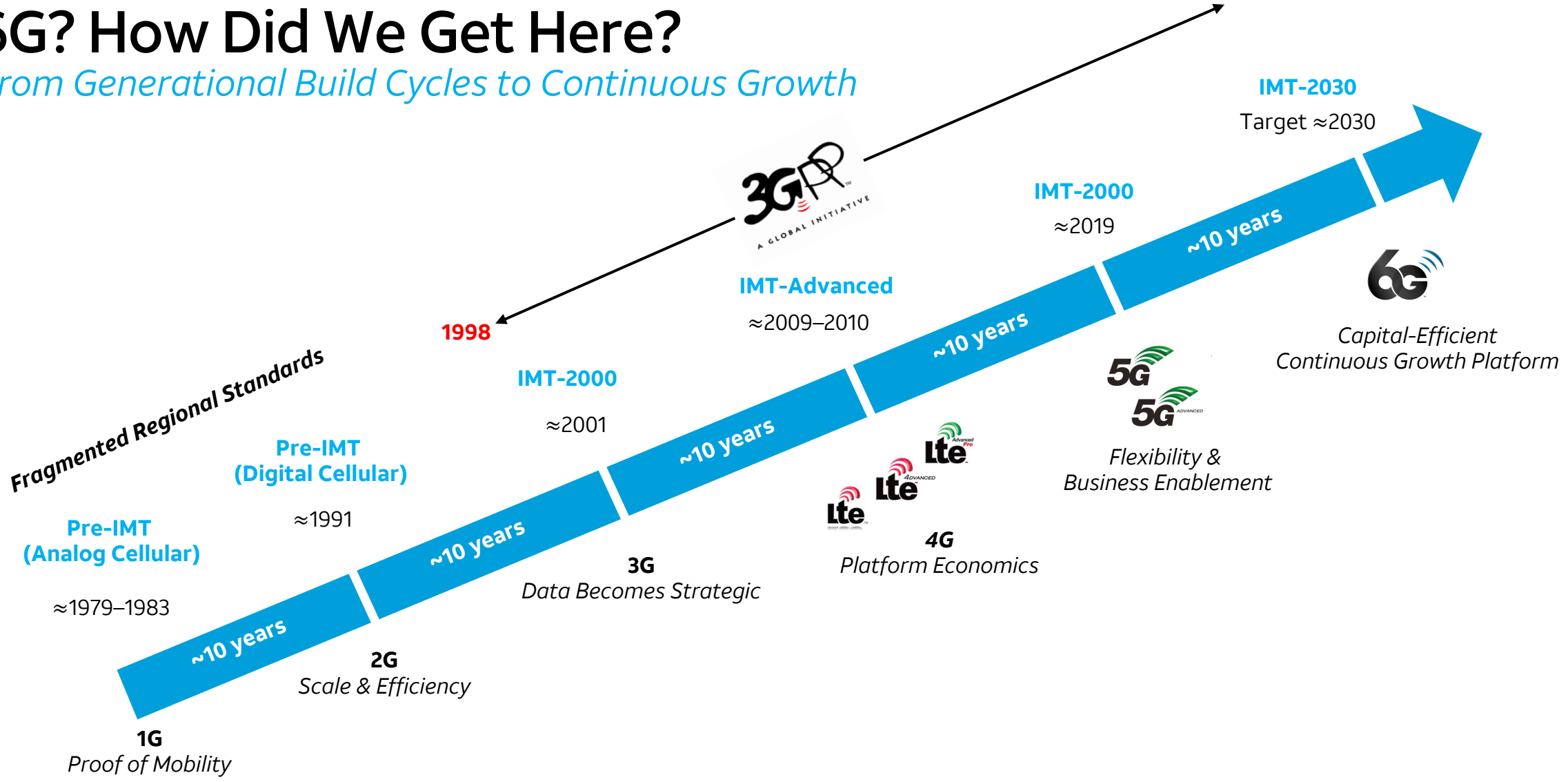
6G? How Did We Get Here?

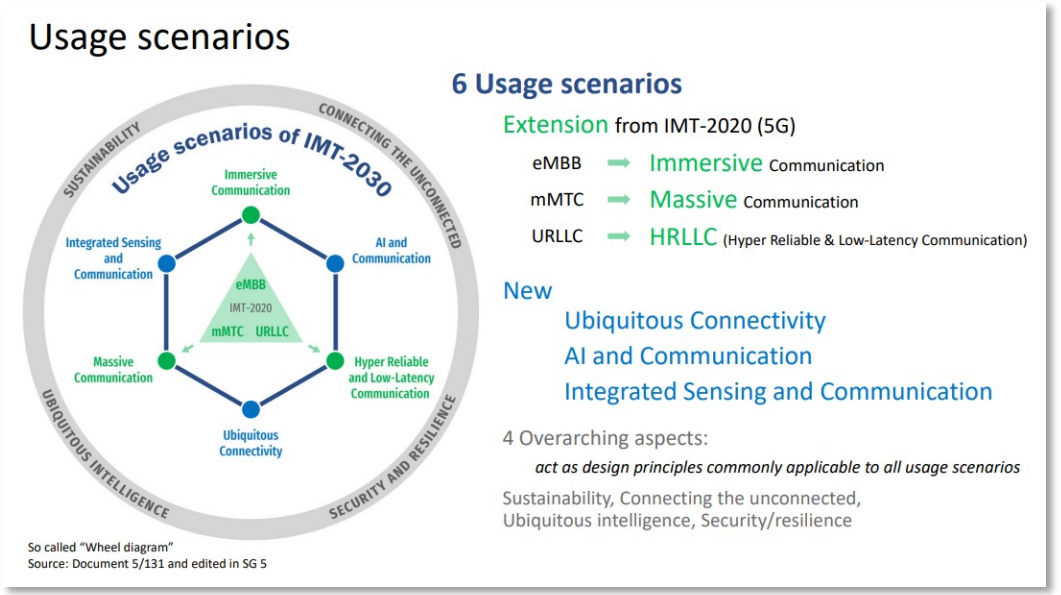
From Generational Build Cycles to Continuous Growth



We want to move from "build, wait, replace" to "build once, innovate continuously."
6G is the inflection point that aligns innovation speed, capital efficiency, and long-term growth.

Core 6G Technology Themes

- AI-native operations
- Security and sustainability by design
- Ubiquitous connectivity across access types
- Open, virtualized architectures with guardrails
- Integrated communication, sensing, and computing
- New Paradigm for Testing & Certification



Source: ITU

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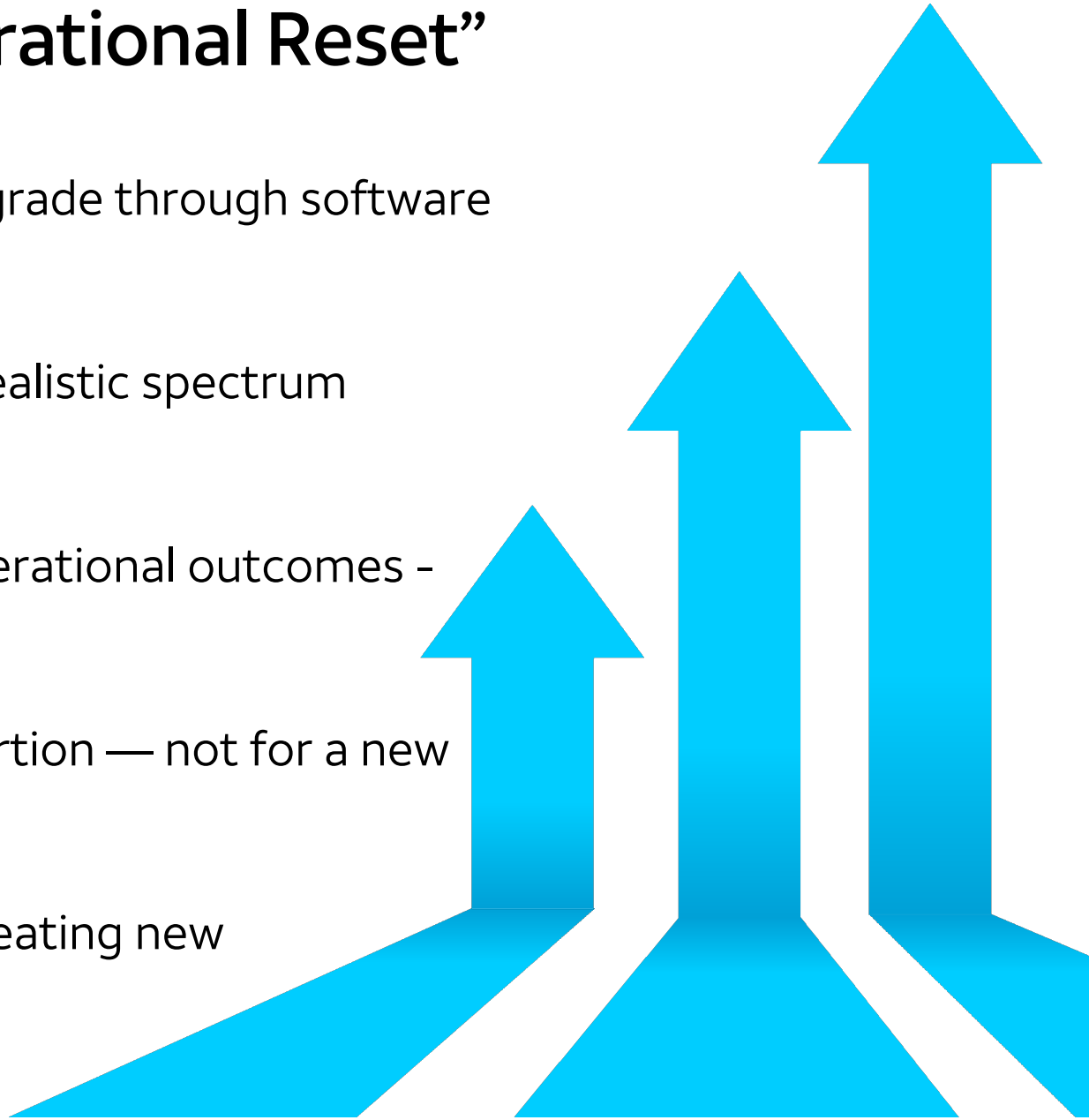
Continuous Innovation vs. “Generational Reset”

- Deploy and upgrade when driven by need; upgrade through software (features, models, automation)
- Avoid defining 6G by peak-rate theater or unrealistic spectrum assumptions
- Minimize forced hardware cycles; prioritize operational outcomes - automation, resiliency, cost/energy efficiency
- Speed comes from Cloud software and AI insertion — not for a new Release label
- The goal: continuous improvement without creating new lock-in or new complexity debt



Integrated Sensing and Communication (ISAC)

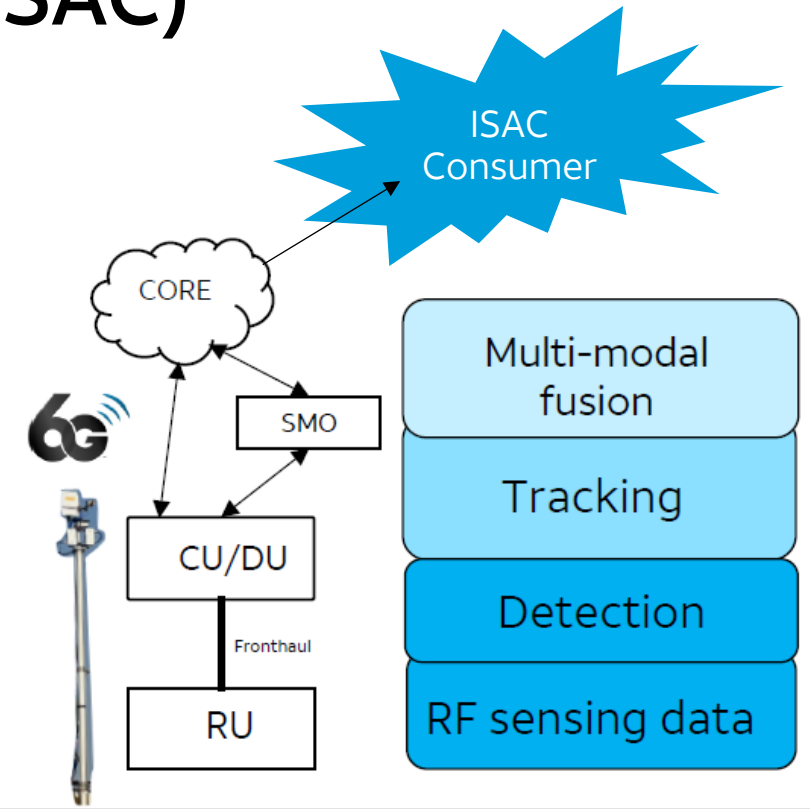
Network-as-a-sensor opportunities

Why it matters:

- Improve network performance and resilience through environmental awareness
- Enable new services beyond connectivity
- Utilizes existing infrastructure rather than deploying standalone sensing systems
- Governance matters: Security, privacy, authorization, and exposure control

Use Case Landscape:

- Network-Centric: Improved positioning, tracking, and mobility management, Operational resilience (e.g., situational awareness during disasters or outages)
- Public Safety & Security: Detection and tracking of passive objects (people, vehicles, UAVs), Critical infrastructure protection
- Transportation & Mobility: Traffic flow monitoring and hazard detection, UAV traffic management
- Industrial & Enterprise Applications: Factory and warehouse monitoring, Asset tracking, Robotics and automation support
- Human-Centric & Smart Environment: Human motion and presence detection, Smart buildings and campuses, Environmental



Key Themes:

- No Persistent Identity
- No Decision Authority
- No Behavioral Inference

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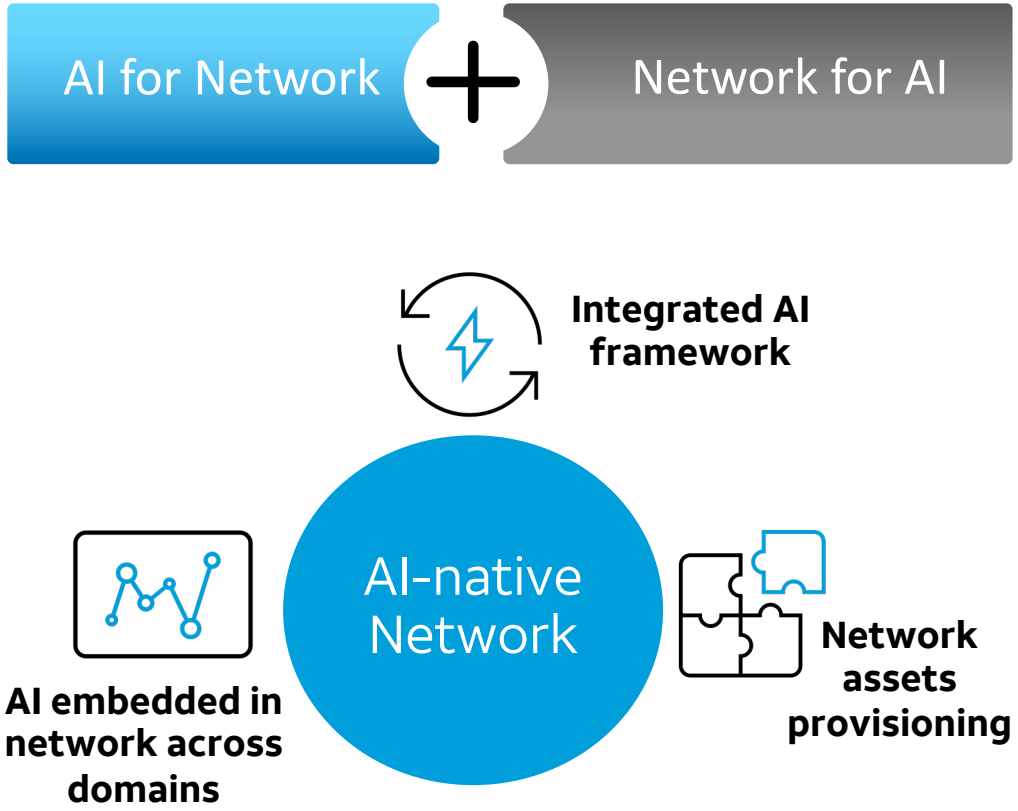
AI-Native Network

Data driven network features and applications powering an efficient, intelligent, sustainable open network

- **Native AI/ML** embedded in/on/for RAN to drive better use/value of spectrum and drive superior user experience
- **Network visibility and control** over data collection drives efficiency, scalability, and performance guarantee while proactively addressing security and privacy concerns
- **Integrated framework for data collection and management** follows the continuous innovation framework of AI/ML model development
- **Unified LCM framework** needed for multiple models to run simultaneously across layers to meet the E2E requirements for various services



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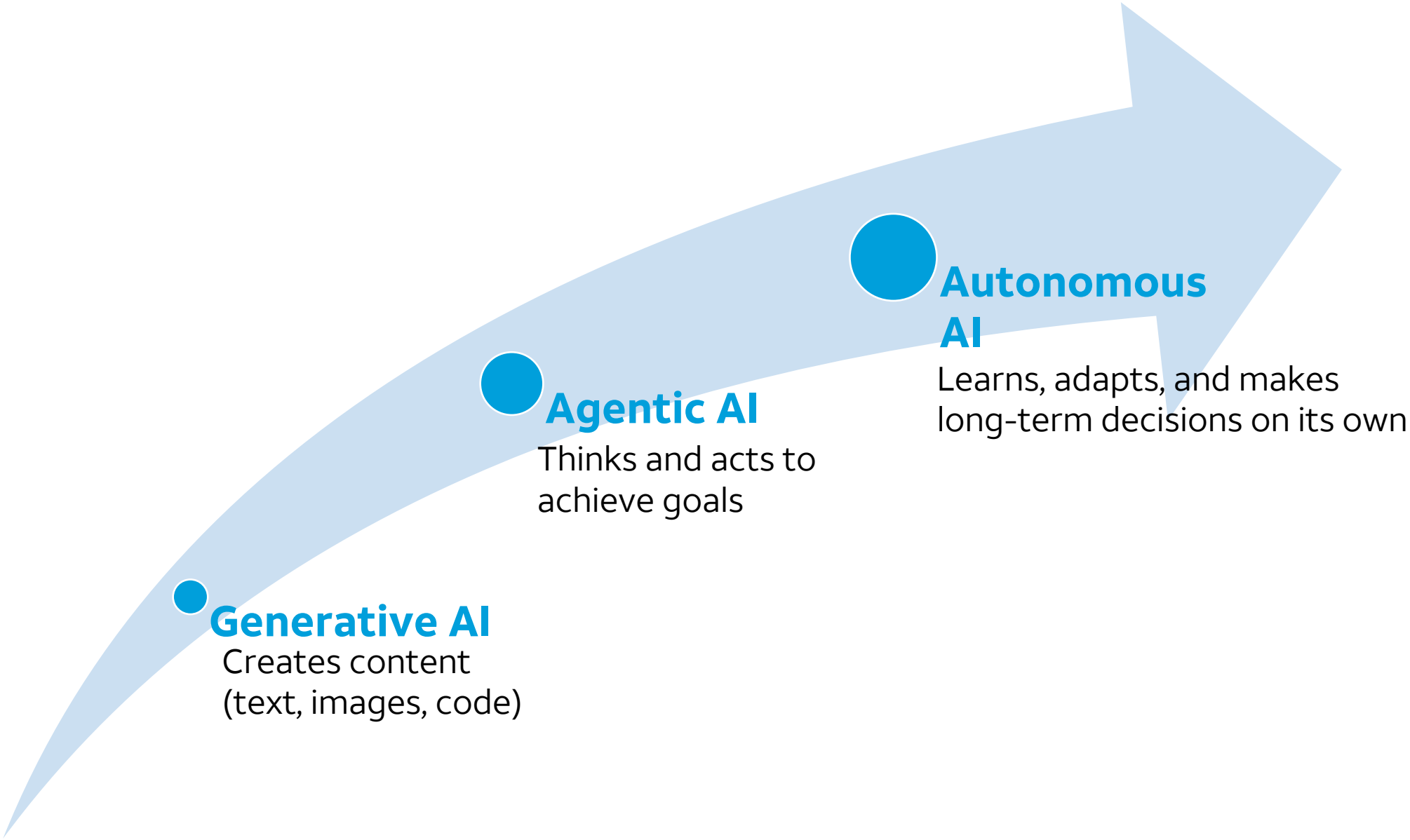
Stages of AI Evolution



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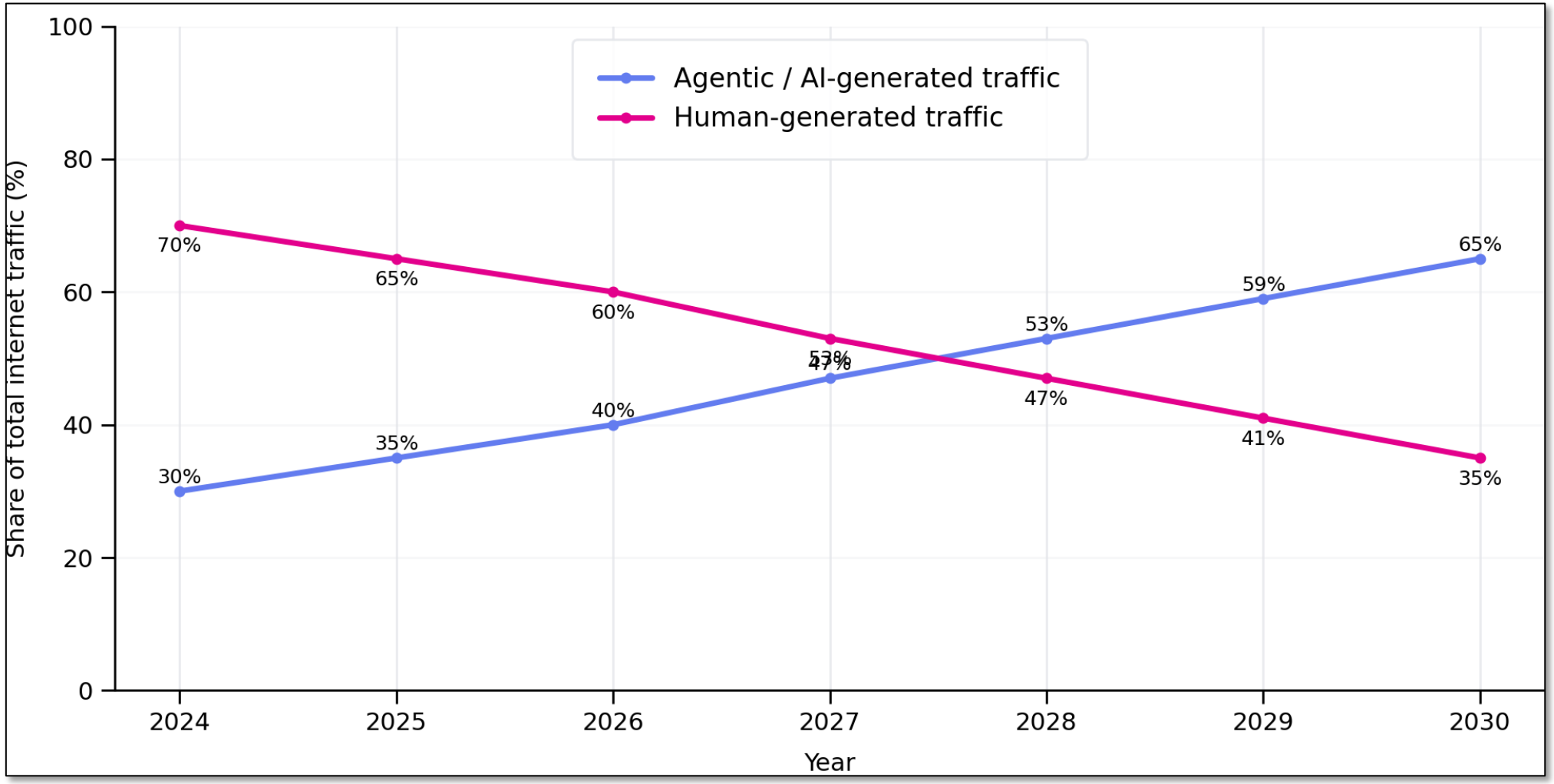
Share of Total Internet Traffic



Sources:
[New-Data-on-AI-Bots-Web-Traffic-in-2025.pdf]
[Cloudflare Radar 2025 Year in Review]
[Hi, robot: Half of all internet traffic now automated | Malwarebytes]

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6G: Reaching for the Stars — Non-Terrestrial Networks (NTN)

Extending the Connectivity Fabric Beyond the Ground

Why NTN Matters for 6G

Global coverage where terrestrial networks cannot reach (remote, maritime, aviation, disaster recovery)

Resilience and redundancy for national-scale infrastructure

Seamless service continuity across land, sea, air, and space

Extends ubiquitous connectivity without rebuilding the network from scratch

NTN as a Native Part of 6G — Not a Bolt-On

Integrated into the single connectivity fabric (terrestrial, fiber, Wi-Fi, NTN working as one)

Standards-based operation aligned with IMT-2030 evolution

Common core, common policy, common security model

Enables continuous advancement, not a parallel satellite silo

Key 6G-NTN Use Cases

Public Safety & Resilience: Backup connectivity during large-scale outages

Transportation & Mobility: Aviation, maritime, and remote logistics

Industrial & Enterprise: Energy, utilities, agriculture, remote operations

Coverage Extension: Rural and hard-to-serve areas without dense buildout

6G NTN is not about "satellites replacing networks"

It's about networks that extend into space, delivering resilience, reach, and continuity as part of a single, intelligent platform.

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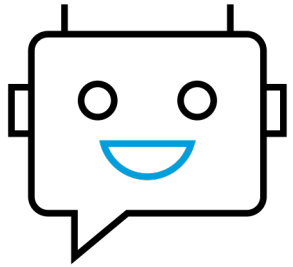
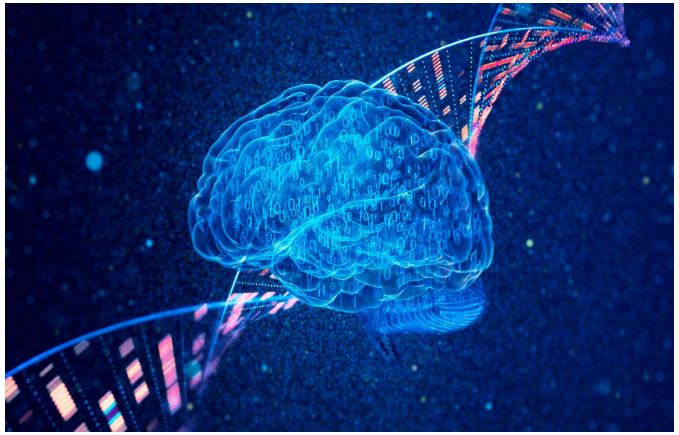
An Open RAN is a Flexible RAN

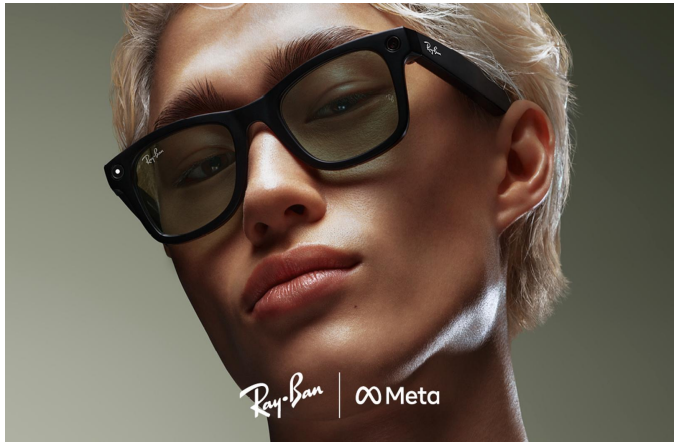
An OPEN RAN enables volume of new traffic from new sources – in many cases – hardly predictable sources

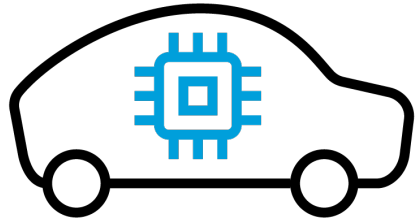


Living Intelligence



XR / VR Googles





RoboTaxis

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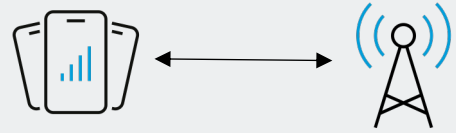
Open AI RAN

*Open RAN sets the stage for **cost-efficient** and **scalable** AI RAN enablement*

Open RAN + A.I. = **AI Native Open RAN**

AI for RAN: Network automation and planning	AI on RAN: Operational efficiency enhancements	AI in RAN: RAN Performance improvements
 **Offline**	**Network Management**  **Inline with network operation**	**Device** **RAN**  **Deeply Embedded in the RAN and/or devices**
Leverage biggest assets, i.e. the network and spectrum efficiently.	**Operationalize and further automate capability and capacity**	**Continue to improve individual user experience**

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Role of Open Source in 6G

A strategic enabler for flexible, interoperable and secure 6G networks — accelerating innovation, reducing cost, and meeting extreme performance goals.

Flexibility & Agility

Software-based, service-based architectures (OpenDaylight, OPNFV, OpenStack, M-CORD, ONAP) let operators rapidly deploy, reconfigure and scale for 6G's terabit throughput and sub-millisecond latency.

Open RAN & HW/SW Decoupling

Open RAN principles extend beyond 5G, letting operators mix hardware and software from different vendors, reducing lock-in and accelerating competition and innovation.

Open Innovation & Collaboration

Community-driven development across academia, industry and government. Shared datasets, simulators and testbeds such as Open6GCore speed up R&D and standards adoption.

Open Standards & Interoperability

3GPP, O-RAN Alliance and ITU-R push open interfaces and vendor diversity, ensuring seamless coexistence with 5G and reducing ecosystem fragmentation.

Security & Transparency

Publicly available source code enables broad security review to find and fix vulnerabilities early, critical for 6G's massive data flows and new applications.

Open Spectrum & Hardware

Open spectrum allocation for experimentation and open hardware projects lower the barriers to entry for startups and researchers.

Open Source

Innovation Pipeline

Why open source defines 6G

- 6G is being designed as AI-native and software-defined, evolving through code rather than fixed-function hardware.
- Open development reduces vendor lock-in and lets operators, vendors, startups and researchers innovate together.
- It complements 3GPP and O-RAN standards and gives industry and governments a trusted, transparent path to next-gen networks.

O-RAN ALLIANCE & OSC

Sets the open, disaggregated RAN architecture and specifications. Its O-RAN Software Community (est. 2018) jump-started open-source RAN, RICs, SMO and rApps/xApps, now migrating into LF Networking.

LINUX FOUNDATION (LFN)

Provides neutral governance and the collaboration hub for open networking. Hosting O-RAN SC, OCUDU and Duranta together completes an end-to-end open-source RAN stack.

OCUDU ECOSYSTEM FOUNDATION

Open-source CU/DU reference platform for 5G and early 6G. Launched at MWC 2026 by AMD, AT&T, DeepSig, Ericsson, Nokia, NVIDIA and others, AI-native and O-RAN compliant.

AT&T views 6G as a strategic, software-driven evolution of 5G designed to deliver new revenue opportunities alongside meaningful cost and efficiency gains, while protecting existing network investments

Go-to-market

Software-driven upgrade path as an evolution to 5G

6G benefits should be achievable without a complete hardware overhaul

- Avoid another expensive hardware upgrade cycle
- Ability to leverage existing open radios in legacy bands
- Hardware upgrades where and when needed

Structural shift from AI as an overlay to AI-native

AI embedded into the network for management and service orchestration

- Better autonomous optimization of network
- Tighter integration of RAN, core, and edge compute
- Spectral efficiencies

Spectrum harmonization

Spectrum priorities focused on existing bands

Large contiguous blocks, strong propagation, and alignment to Big Beautiful Bill

- Advocate studies of the 4.4-4.94 GHz band
- Reassess the CBRS band for high-power auction
- Deprioritize consideration of 7 GHz as a “de-facto” 6G frequency

Vendor ecosystem

Cloud/O-RAN driven, single-architecture strategy

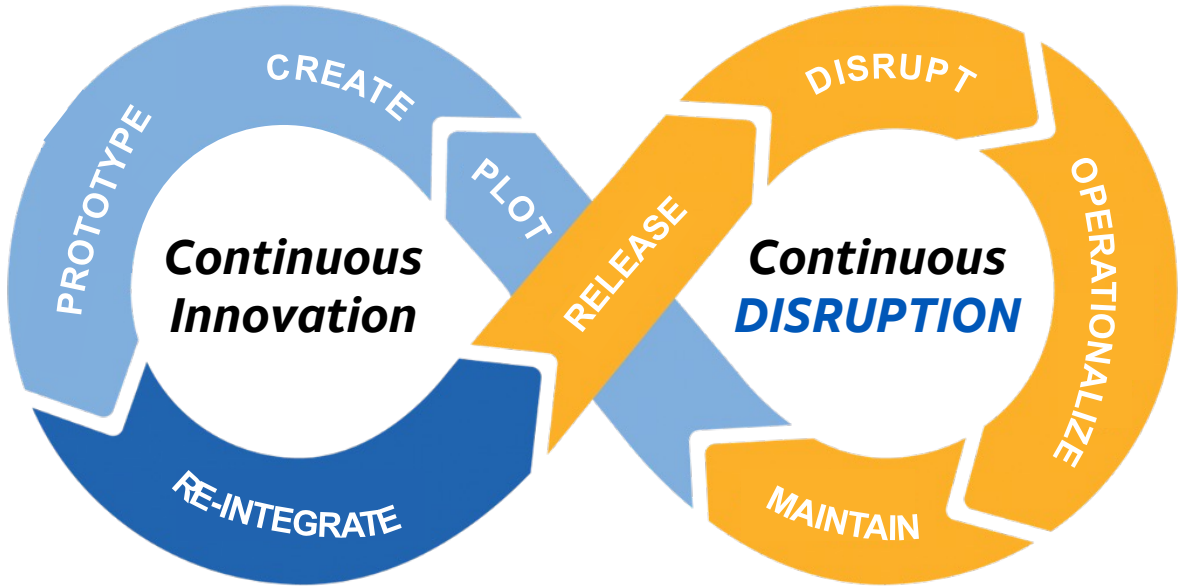
Open, virtualized, and interoperable architectures to improve supply chain resiliency

- Deliver incremental capability gains (sensing + security + integrated compute)
- Material opex and efficiency improvements

Sources: AT&T Network Team

Continuous Innovation, Leveraging Investments

Moving towards a continuous innovation/continuous disruption model - independent of a "G"



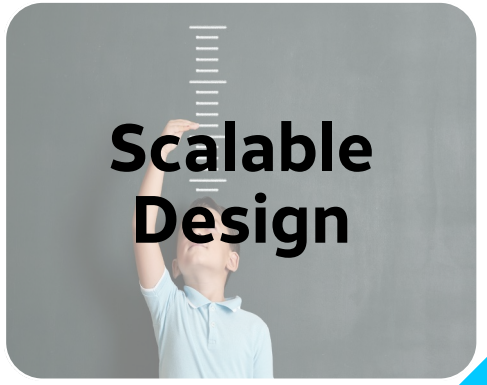
- Ongoing network transformation is towards long-term architecture
- Through the ongoing wireless network transformation, AT&T is going to modernize nearly every one of the AT&T cell sites*
- Need investments to last into 6G timeframe
- 6G deployment should not require complete overhaul of hardware to realize benefits
  - Software-driven 6G deployment with existing open radios in legacy bands leveraging efficient 5G-6G MRSS, where and when needed**
  - Full capability of 6G realized with radio refresh in existing bands or in new greenfield bands as driven by business needs
  - New testing/certification paradigm to enable features as and when needed

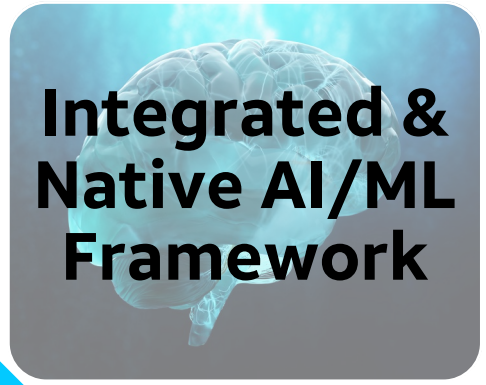
* AT&T Inc Analyst & Investor Day. (Dec 3, 2024). Transcript.
** Differentiate between software vs. hardware-impacting non-backward compatible changes (with potentially some limitations)

6G Priorities

Globally aligned test/ certification procedures enabling mandatory features

Scalable modular design
Support diverse device types (incl. LPWA) on Day 1





MNO visibility & control of data collection
Integrated model training, delivery and LCM

Software-driven deployment
Needs-based HW refresh

Network as a sensor for new cases and services

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What to do now (next 1 to 2 years)

Open/virtualized / cloud-native in 5G / 5G-Advanced

Do not wait for 6G to realize the benefits

Zero Trust Now

Operational controls + verification in 5G/5GA; carry forward to 6G

Align a “6G North Star”

Open architecture, portability, security by design, national deployability — not showcases

AI-native operations

genAI to reduce ops friction agentic AI for policy-driven closed-loop control

Invest in interoperability guardrails

Conformance + certification so “open” is deployable at scale

Compute as a first-class resource across cloud operator domains

Keep workloads portable across locations & suppliers

What This Delivers

Lower cost/complexity, faster innovation, reduced lock-in risk, stronger resiliency

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Turning Someday Into Everyday


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APPENDIX

The Tagline …

What do we want 6G to be? What should it deliver for the industry, society, and the business?

We want 6G to be a disciplined advancement of 5G—turning the network into an AI native, open, programmable platform.

For the industry, that means **simpler architectures** and **better economics** built on top of what has already been deployed (not another reset).

For society, it means **more resilient and sustainable connectivity** (we think of connectivity across all access types, fiber/WiFi, Satellite and of course wireless technology).

And for AT&T, **success is operational value**—automation, efficiency, and scale—not just higher peak speeds and of course we would love to see new revenue opportunities.

One Big Beautiful Bill Act (OB3A): 800 MHz of Spectrum

Covered Bands: 1.3 GHz - 10.5 GHz excluding 3.1 GHz - 3.45 GHz and 7.4 GHz - 8.4 GHz

Tranche 1 (FCC) – Auction at least 300 MHz for full power commercial use cases

2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034

July 4, 2025
OB3 signed into public law 119–21

July 4, 2027
AUCTION
FCC deadline to auction at least 100 MHz of the 300 MHz from 3.98 to 4.2 GHz

Federal Communications Commission

Up to 7 years:
To auction remaining 200 MHz

Federal Communications Commission

Sept 30, 2034
AUCTION
FCC deadline to auction remaining 200 MHz of the 300 MHz by end of auction authority

Tranche 2 (NTIA) – Identify and reallocate 500 MHz federal to non-federal

2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034

Biennial reports:

NTIA

"Timely" spectrum analysis of:
2.7 GHz to 2.9 GHz
4.4 GHz to 4.9 GHz
7.25 GHz to 7.4 GHz

NTIA GOAL: identifying the best approach to **maximize net proceeds** of systems of competitive bidding (auction)

July 4, 2027
NTIA deadline to identify at least 200 MHz

2 years:
From identify Spectrum to Auction

Federal Communications Commission

July 4, 2029
NTIA deadline to identify remaining 300 MHz

July 4, 2029
AUCTION
FCC deadline to auction at least 200 MHz of the 500 MHz

4 years:
From identify spectrum to auction

Federal Communications Commission

July 4, 2033
AUCTION
FCC deadline to auction remaining 300 MHz of the 500 MHz

Sept 30, 2034
NTIA $50M additional support funding ends
- NTIA publishes last Biennial report

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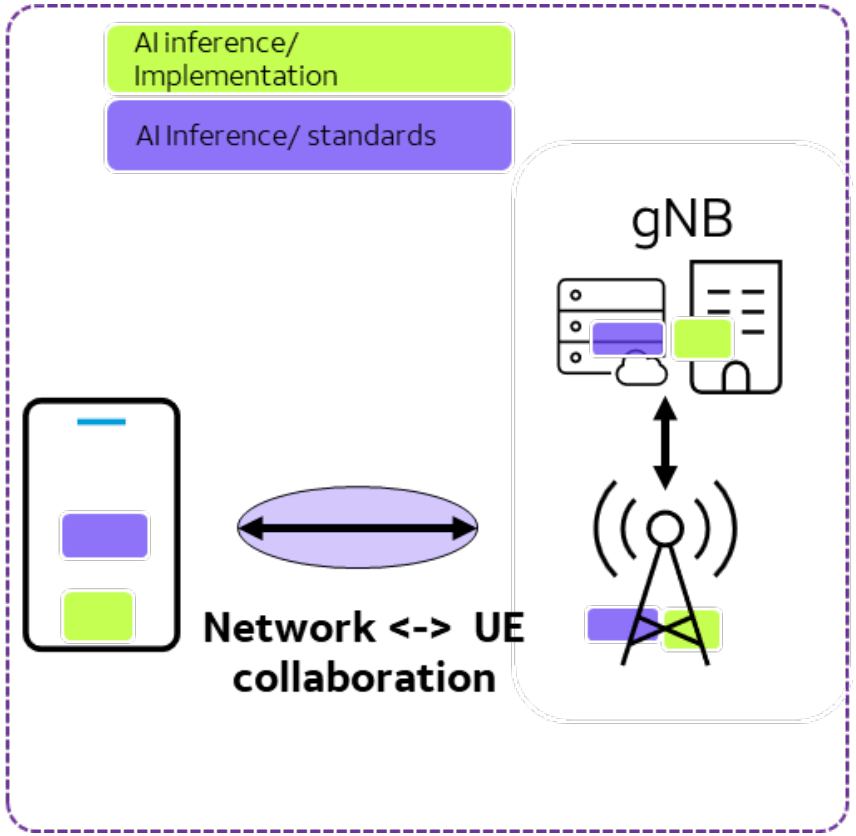
AI RAN Use Cases

Example use cases:

CSI prediction	Beam prediction and management	CSI compression
DMRS overhead reduction	Measurement prediction (for mobility)	TA prediction
Link adaptation	Power control	Traffic prediction
Network energy savings	Mobility optimization	PA non-linearity compensation



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