Milestones on the Path to 5G

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Mobile Networks CTO, Nokia
- Small, Invisible
- Follows the user
- Organic
- Green
- Cloud led
Fundamental architectural transformation required to bring future networks to life

Today
Vertical architecture
Static network design and services
Closed

Future
Cloud Optimized architecture
Dynamic network design and services
Open

Path to 5G era
Future-X network architecture vision for the 5G era
Cognitive, converged, cloud-optimized network evolution

1. Massive Scale Access
2. Converged Edge Cloud
3. Smart Network Fabric
4. Universal Adaptive Core
5. Programmable Network OS
6. Augmented Cognition Systems
7. Digital Value Platforms
8. Dynamic Data Security

- Humans & Machines
- Access Remote
- Long fibers
- Short waves & wires
- Open APIs
- External data sources
- Digital Value Platforms
- ANP, CSP, ICP, Vertical apps
- New trust framework
- Ecosystem sharing
- Mass edge monitoring
- Multi-operator federation
- Dynamic network optimization
- Dynamic customer services
- SDN, NFV
- Management & Orchestration
- Dynamic Data Security
- Common data layer
- Self-optimized coverage & capacity
- Access agnostic converged core
- Modular, decomposed network functions
- Smart Network Fabric
- Software defined, end-end
- Augmented Cognition Systems
- Machine learning
- Analytics
- Open APIs
- External data sources
- Humans & Machines
- Converged Edge Cloud
- Access Remote
Technology building blocks for realizing 5G era vision
Revolution through evolution

Evolutionary
- Automation, SON
- IoT Optimization
- Ultra Dense Small Cell Cluster
- Carrier Aggregation
- X-Haul
- Security
- Spectral Efficiency
- Management & Orchestration
- D2D, V2X
- Unlicensed Band MuLteFire
- Virtualized Functions

Revolutionary
- E2E QoS/QoE
- mMIMO Beamforming
- Sub - 3 GHz, 3-6 GHz
- Multi Connectivity
- Distributed Edge Cloud
- Shared Data Layer
- Mobile Edge Computing
- SDN
- Open APIs, Programmable Core
- Novel Radio
- Network Slicing
- Analytics & Cognitive Cloud
- >6GHz, cmW/mmW
- Carrier Aggregation
- Cloud RAN
- Multi Connectivity
- Distributed Edge Cloud
- Shared Data Layer
- Mobile Edge Computing
- SDN
- Open APIs, Programmable Core
- Novel Radio
- Analytics & Cognitive Cloud
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- Multi Connectivity
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Technology milestones towards 5G era

We are here

- **4.5G**: 600Mbps, >10ms
- **4.5G Pro**: 1Gbps, ~10ms
- **4.9G**: >1Gbps, <10ms
- **5G**: >10Gbps, 1ms

- **2016**: LTE16 Releases
- **2017**: LTE17 Releases
- **2018**: LTE18 Releases
- **Phase 1 2018**

Nokia Common AirScale Platform from 2017
Expanding the human possibilities of the connected world

- 5G-connected humanoid robot for rescue mission, under human control
- Health Care: 3D model remote analysis
- Flying drones, facial recognition, unauthorized personnel access control
- Sync View, 360 VR, Hologram Live
Thank you

Ecosystem collaborations, open innovation and partnerships are key to success in the 5G era.