

Future Network: NOW

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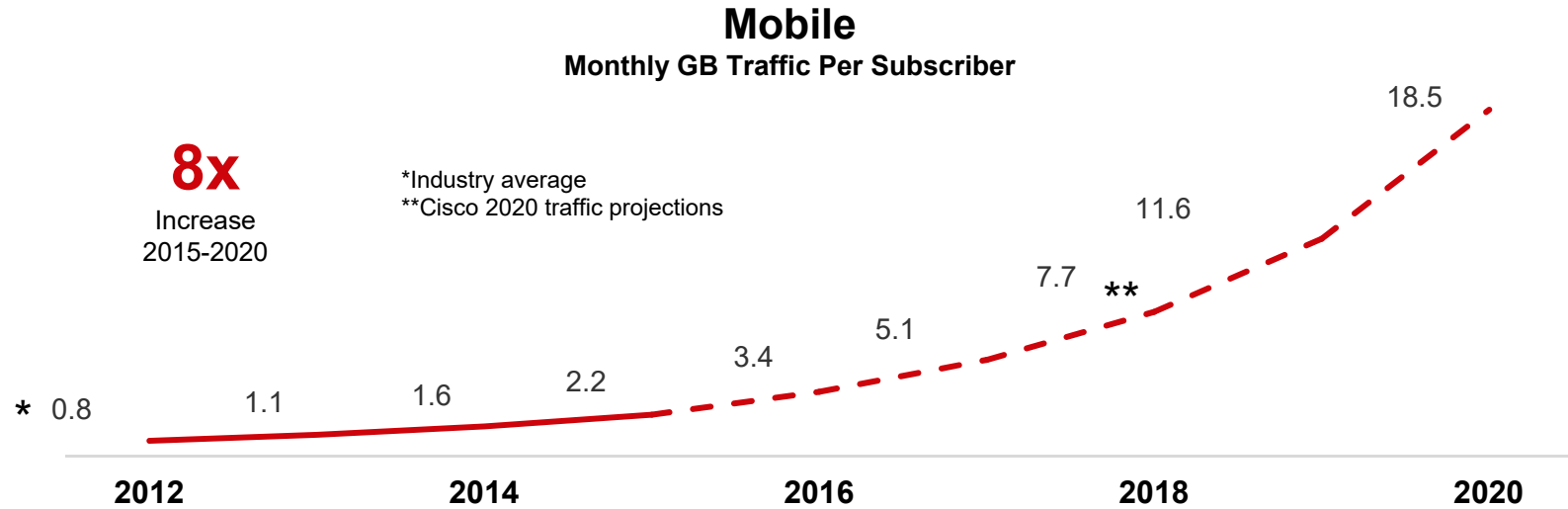
Thank you.



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**Customer demand
seems nearly
insatiable.**

Growing Appetite for Bandwidth



Key Demand Drivers and Impact

Video Streaming
Incremental



Multiple Devices
Incremental



4K TV (UHD)
Exponential



Augmented Intelligence
Exponential



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Evolving Network Use

TECHNOLOGY PROGRESSION



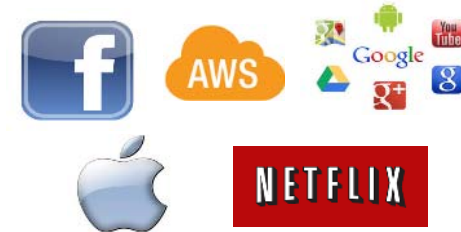
Accelerating innovation and business models

TOMORROW'S WEB



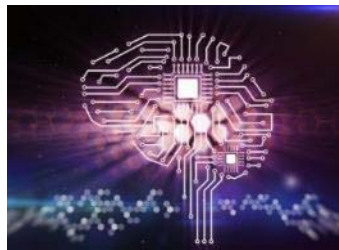
Physical and digital world integration

INFORMATION ISLANDS



Hyper giants driving Internet traffic

ON-DEMAND NETWORKS



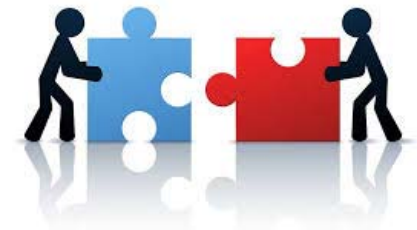
Virtualization and Open Source

NEXT GEN MOBILITY



Machine mobility and autonomous vehicles

SMART DATA MANAGEMENT



Traffic optimization, deep analytics

**The Network is
evolving rapidly
across several fronts...**

RAN Design Evolution

Low and tight RF

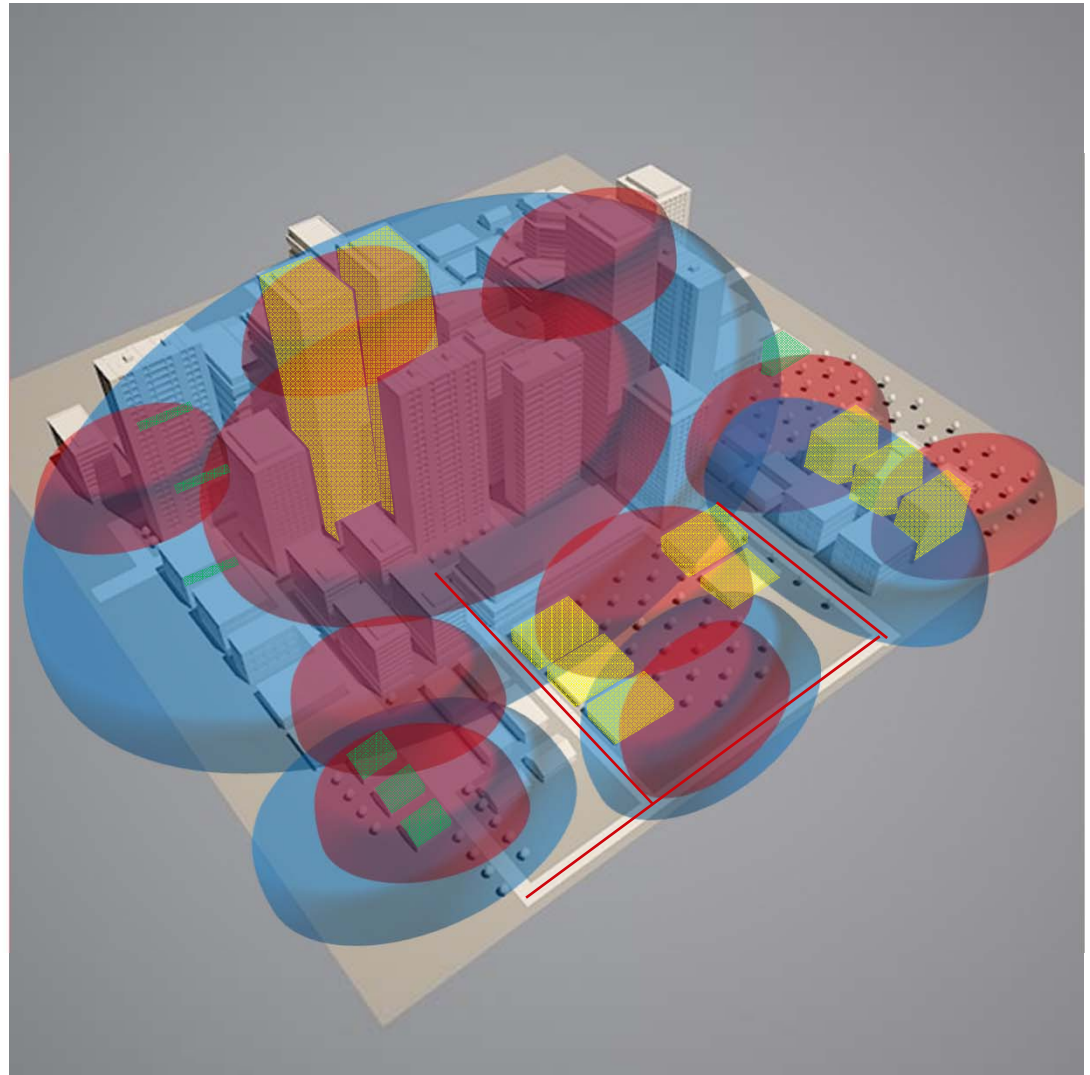
- Macro cells
- Small cells/DAS
- In-building
- Spectrum layers

Dense urban coordination

- Deep fiber
- HetNet

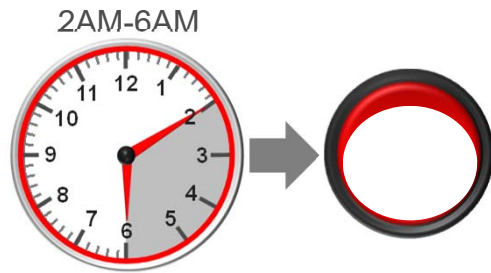
Advanced automation, analytics, scale, control

- C-RAN
- SON
- Virtualization

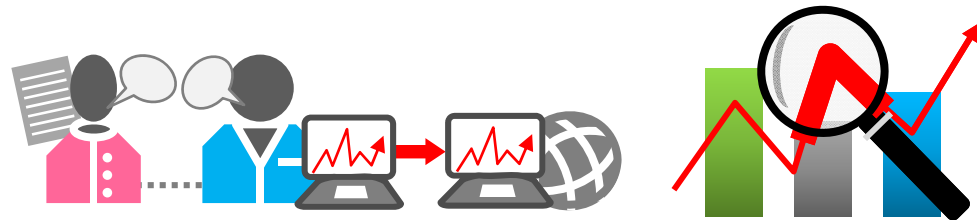


Virtualized Network Functions

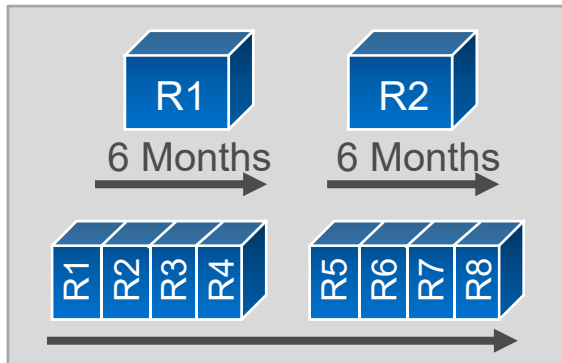
FLEXIBLE CHANGE MANAGEMENT



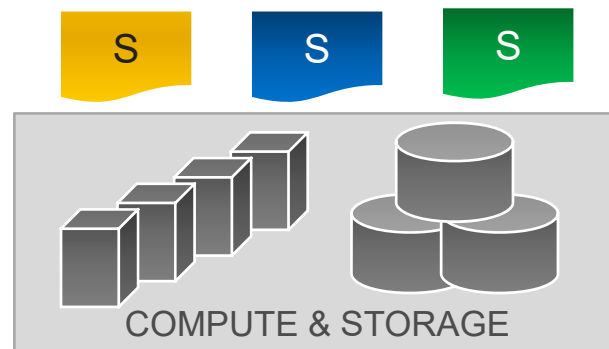
AUTOMATION & ANALYTICS



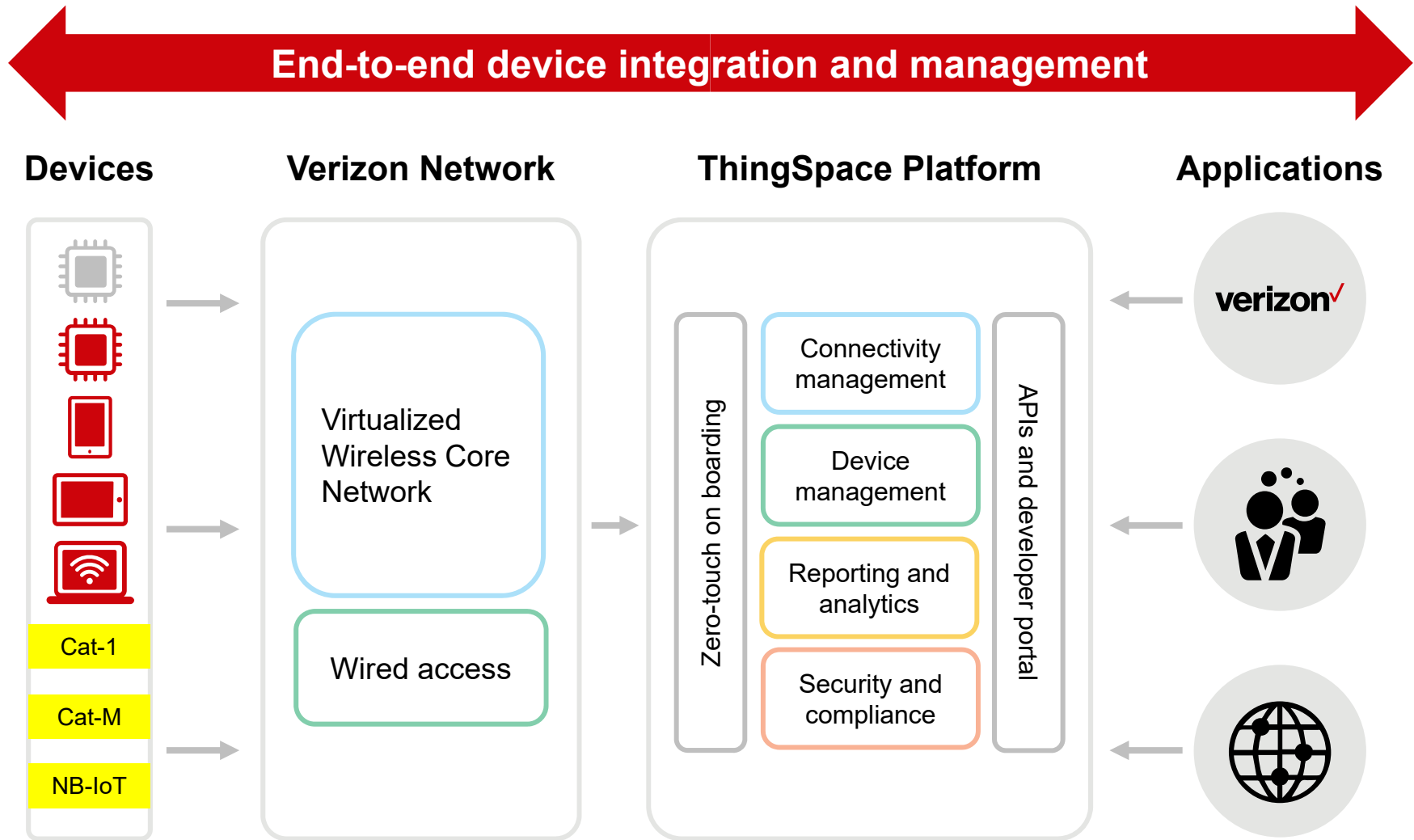
MICRO RELEASES



SHARED RESOURCES



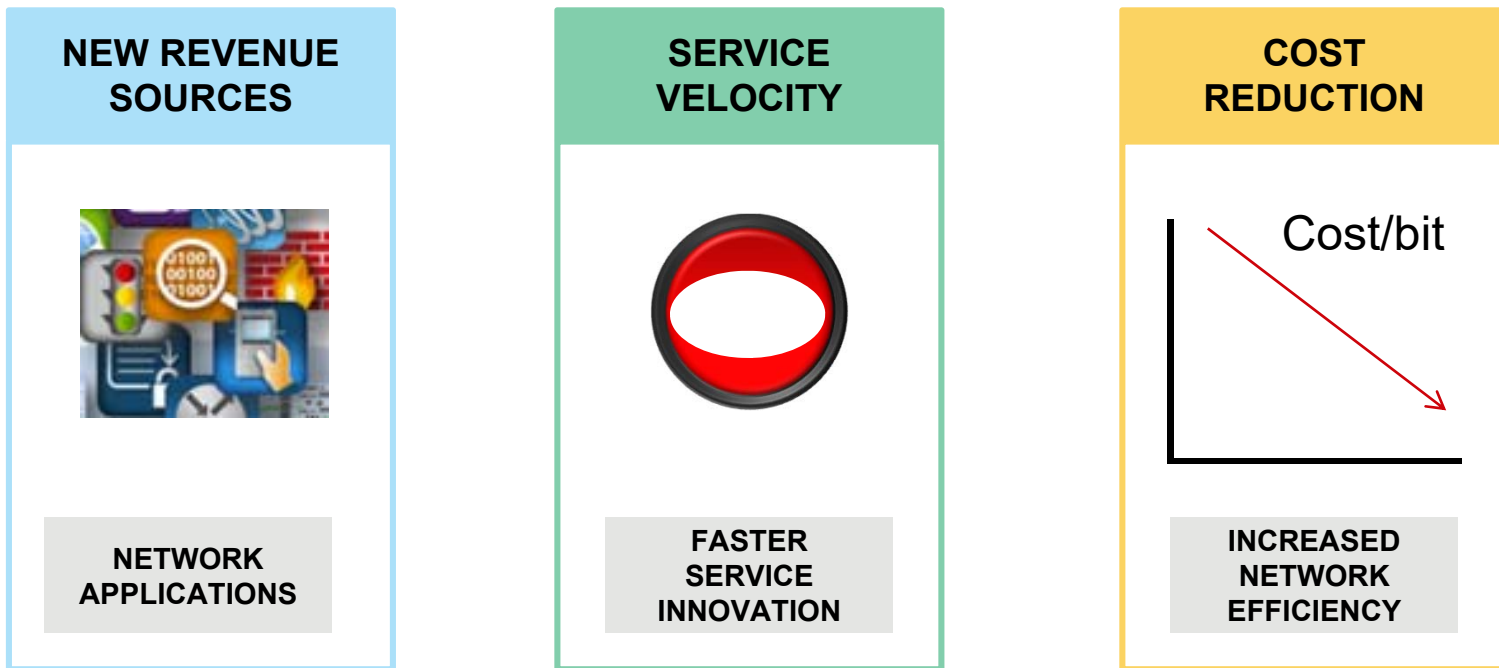
Internet of Things



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**...and the expectations
of the Network are
expanding.**

Network Expectations



- Better, faster, cheaper – and you can't just pick two
- Redesign networks to make them intelligent and orchestrated
- Enable agility and automation

Rethinking “Edge”

Future Network expectations

- <10 millisecond round trip latency
- Persistent & secure coverage
- Gigabit bandwidth at the edges

Networks enabling

- Autonomous vehicles & drones
- Edge caching and optimization
- Virtual and augmented intelligence
- High bandwidth processing & real-time decisions

Smart Cities and Autonomous Vehicles



vEDC Edge Data Center Cellular
Vehicle to Vehicle Fixed Wireless
Vehicle to Infrastructure

Augmented Intelligence



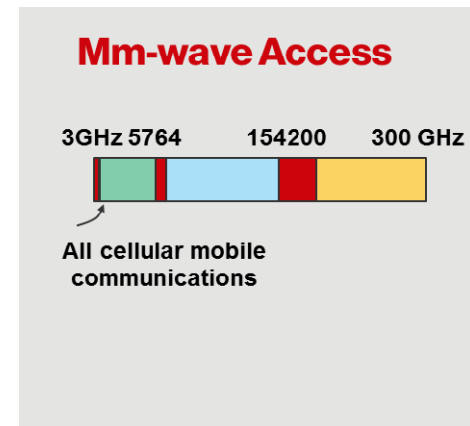
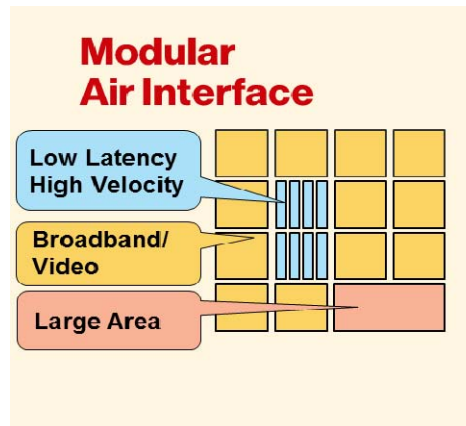
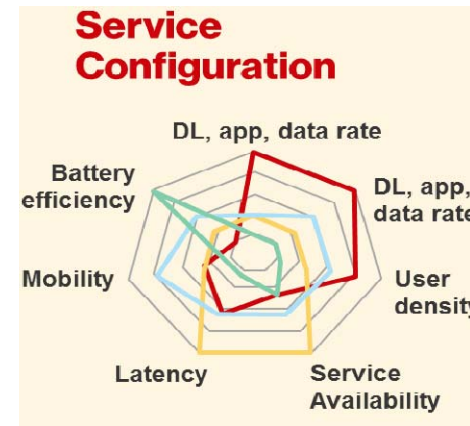
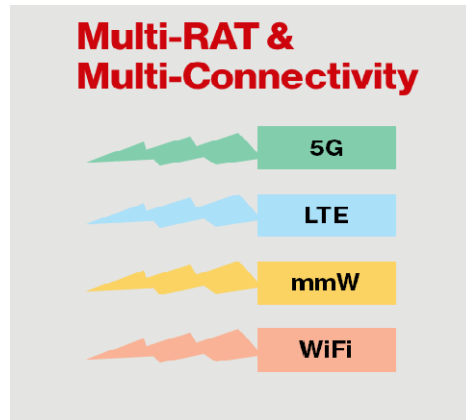
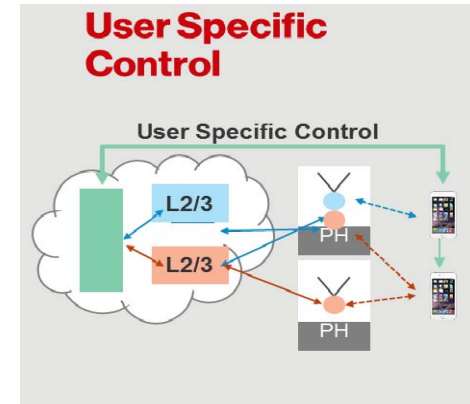
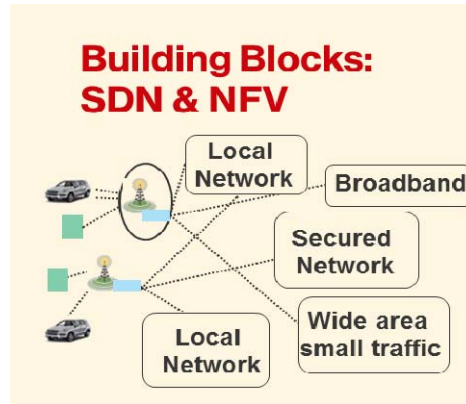
Edge Analytics



**As 5G is defined, the
building blocks are
there.**

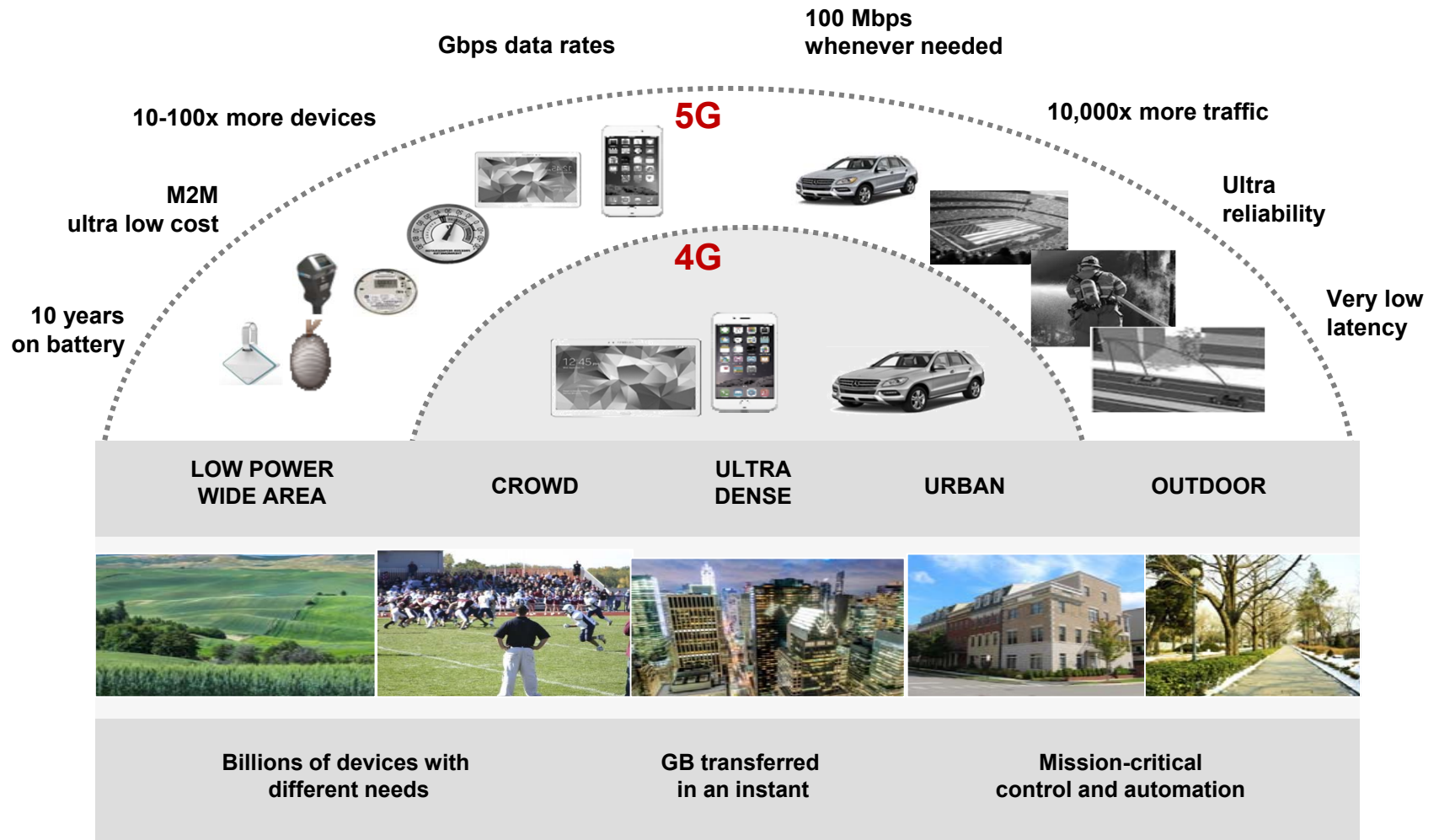
Multiple new technologies being developed.

Building blocks:
Density
LTE-A
C-RAN
Virtualization
LTE-U/LAA



**So, now is a really
good time to be
excited about what's
next.**

Wide Range of Use Cases



Verizon 5G Technology Forum Partners

CHIPSET

DEVICE

NETWORK

SERVICES



NOKIA



ERICSSON

R&D and Technology
Investment
Passion for Innovation
Large Global Community



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5G Open Trial Specification Alliance



- Common Agreement on 5G Technical Specifications
- Open, Inclusive and Collaborative Approach (chipset/device vendors, network vendors)
- Drive & Shape Vendor Adoption
- Acceleration of Commercial Solutions
- Use Case Development & Validation

What Verizon Is Focused On

Technology Partners and Development Plans

Spectrum Policy and Framework

Technology Field Trials

Advance 5G Standards and Process

Mobilize the Ecosystem



The technology of the future is here.

The ecosystem is being primed.

The opportunity is now.

Action is needed.

Let's get after it.

Putting Wireless (5G & Beyond) in a Logical Context

Just a little "bit" to think about; wireline & wireless trends not mutually exclusive!

Broadband technology is critical to remaining a viable leader in the communications industry.

Rapid network transformation is critical to making that transition to a broadband / 5G world.

Migration is driven by customer demand for access, competition & deregulation.

The timing & technology transition is & will remain a function of business cost-benefit analysis.

Broadband expansion is at a hyper-critical point in the history of telecommunications networks.

The transition of the wireless industry to a 5G platform is rapidly escalating the need for fiber.

The next 10 years will be a period of historic transformation to a broadband & wireless world.

Expect an explosion in M & A, industry consolidation, CAPEX investment, & device connectivity.

Expect differences between landline & wireless; Telco & CATV become virtually indiscernible.

Expect competition to be intense inside & outside ILEC territories, across the nation & the world.

Expect urban densely populated areas to experience the transition first....& the rest follow later.

Current political climate will play a critical role in facilitating rapid infrastructure changes (maybe).

Vision requires leveraging assets we currently have & CAPEX in what we don't!



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Consider Wireless Assessment Valuation in a Logical Context

Wireline & wireless trends are not completely mutually exclusive!

Time value of money (DCF model).

CAPEX cost investment does not equal value (at least not immediately & possibly never = RISK).

Transitioning technology always leads to redundancy and overbuilt duplicative network elements.

- **Migration is driven by customer demand for access, competition & deregulation.**
- **Timing & technology transition is a function of business cost-benefit analysis and risk.**
- **Next 10 years will be a period of historic transformation to a broadband & wireless world.**
- **Explosion in M & A, industry consolidation, CAPEX investment, & device connectivity.**
- **Expect differences between landline & wireless; Telco & CATV to be virtually indiscernible.**
- **Expect intense competition inside & outside ILEC territories, across the nation & the world.**
- **Expect urban densely populated areas to experience the transition first & the rest follow later.**
- **Current political climate must play a critical role in facilitating rapid infrastructure changes.**

All this adds up to a hyper-critical need for obsolescence recognition & time value of money (DCF).

- **Physical deterioration**
- **Functional obsolescence (3 types; deficiency, need for modernization & super-adequacy)**
- **Economic obsolescence (ruinous competition, regulatory obstruction & lag (temp or perm))**



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