
: Designing Storage Architectures for Digital Collections

September 9, 2019

LIBRARY LIBRARY OF CONGRESS

What I think is going to happen and why

TO UNDERSTAND WHERE WE ARE GOING, IT'S IMPORTANT TO UNDERSTAND HOW WE GOT HERE

Disruptive change coming to communications

- How we get and manage content will change for just about everything

This will impact everything from Governments to autonomous transportation

5G communication will increase the amount of data coming in from the edge by several orders of magnitude and therefore change the economics and requirements for storage

Security and latency will matter more?



What is the Edge?

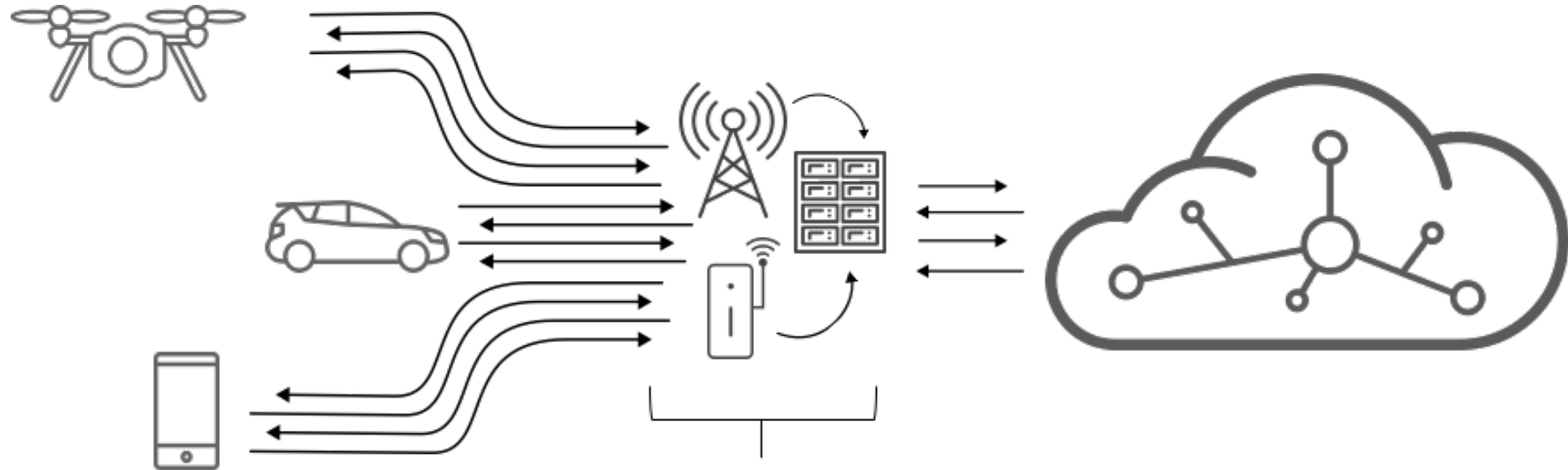
From a Centralized Hyperscale - to be Closer to the Data Sources

The Edge is defined by the movement of:

- Data activation
- Computing
- Storage



The Edge - Data Performance and Security Challenges



- Endpoint Attestation
- Data Provenance / Integrity

- Multi-tenant & shared resources
- Limited physical security
- Chain of data custody

Communications change coming

BACKGROUND ON THE CHANGE IN PROGRESS

Amazon will launch thousands of satellites to provide internet around the world.
3,236 satellites will provide internet from low Earth orbit

- <https://www.theverge.com/2019/4/4/18295310/amazon-project-kuiper-satellite-internet-low-earth-orbit-facebook-spacex-starlink>

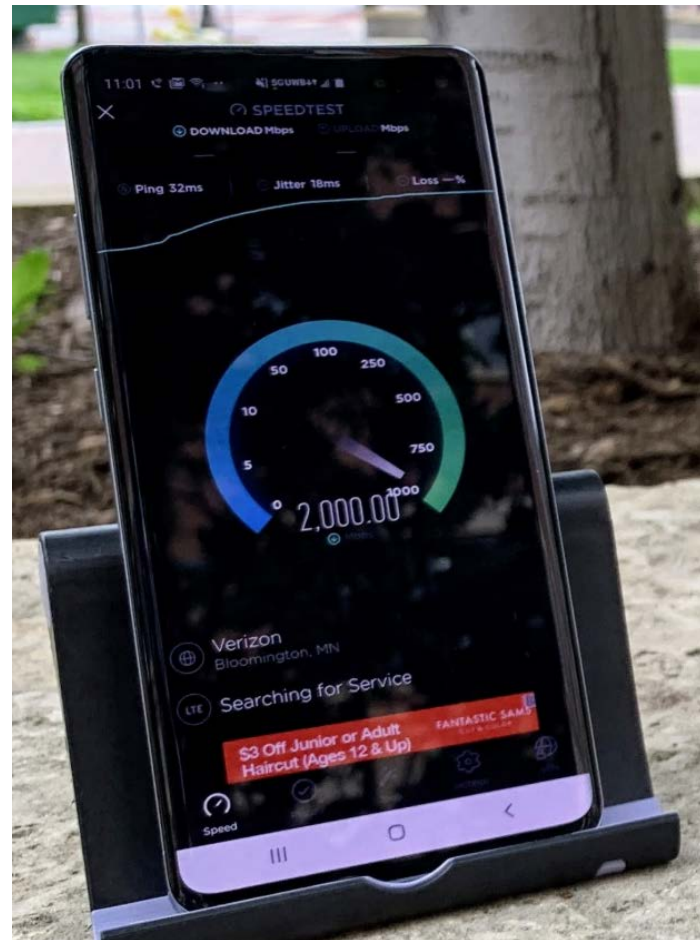
“AT&T smashes Verizon's peak speeds Test after test, AT&T's 5G network topped Verizon's fastest network speeds -- 1.8Gbps on AT&T and 1.3Gbps on Verizon”

- This is ground station bandwidth of the late 90s on your phone!
- <https://www.cnet.com/news/verizon-vs-at-t-vs-t-mobile-vs-sprint-5g-we-compare-their-peak-speeds/>
- And 5G supports up to 10 Gbps per device new towers required
 - Estimate per tower of 200 phone and 200 fixed devices (homes) is 4 Tbps required per tower
 - Estimate of 250,000 towers required nationwide or 1 Ebps
 - <https://www.nwnetwork.org/post/wireless-carriers-lobby-access-street-furniture-washington>



This stuff is really happening today!

<https://www.twincities.com/2019/07/18/broadband-on-the-go-verizon-turns-on-speedy-5g-service-in-parts-of-st-paul/>



Estimate Cloud bandwidth

THIS IS A DEEP DARK SECRET BUT HERE IS AN EDUCATED GUESS

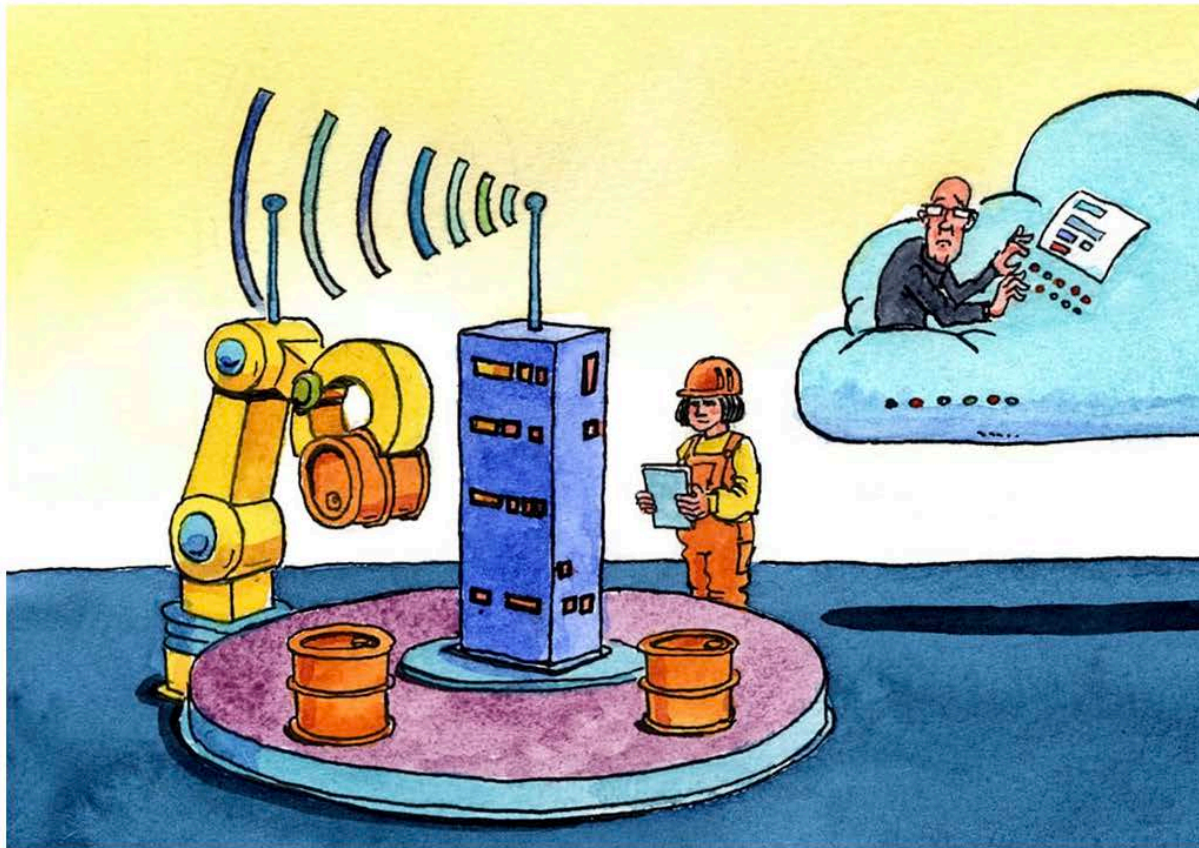
Depending on the provider, the total capacity available (worldwide) here will range from 50Tbit to 1-2Pbit (for the larger clouds)

- This one is hard to put a point on but got this from multiple sources



The era of the cloud's total dominance is drawing to a close

The rise of the "internet of things" is one reason why computing is emerging from the centralised cloud and moving to an "edge" of networks and intelligent devices



Blowing away the cloud

Connected devices, worldwide, bn

- Internet of things*
- Mobile phones
- PC, laptop & tablet
- Fixed phones



Source: Ericsson

*Everyday objects connected to the internet

Current compute/storage model does not work for space

IT IS ALL ABOUT \$\$

Cost of connectivity to storage is high in terms \$/GB/sec

- This trend has been going the wrong direction for decades

Latency between compute and storage has improved with NVMe but at a high \$ cost

- As John Mashey said, “Money can buy you bandwidth, but latency is forever”

SGS has been involved in Active Drive for about 4 years and that is the answer for storage and processing in space



Lead, Follow or Get Out of the Way

GEORGE PATTON

The future is changing fast

- Comcast, CenturyLink and other wired providers are in trouble
 - This is why home fibre installations have slowed dramatically as you cannot recover cost in the time left
 - Content delivery companies (NetFlix, Spotify etc) are going to be controlled bandwidth providers
- Terrestrial Internet bandwidth everywhere world wide will be exhausted
- Storage hierarchies must exist given data volume and costs

USG must ride this wave as they cannot afford anything else, new security models are coming fast

- DRM
- New access and security models such as 0 Trust

