

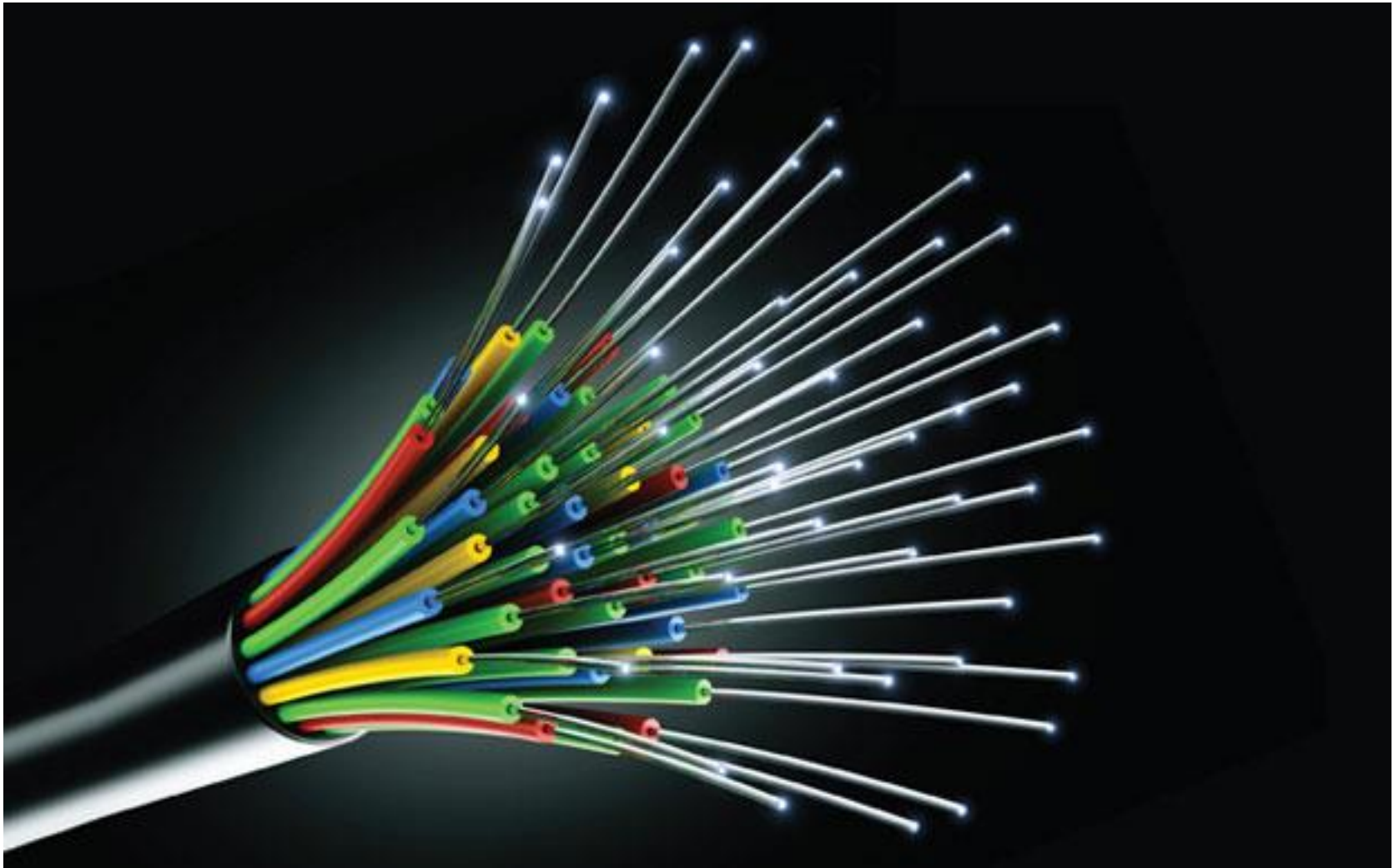
Smart South Bay

Why South Bay Cities
Need More Bandwidth

Why am I Presenting?

- City Councils will in the next 90 days make a decision about whether to join a consumer consortium that will purchase much larger quantities of network capacity at lower costs
- Start discussing why cities need much more bandwidth.

Fiber Optics

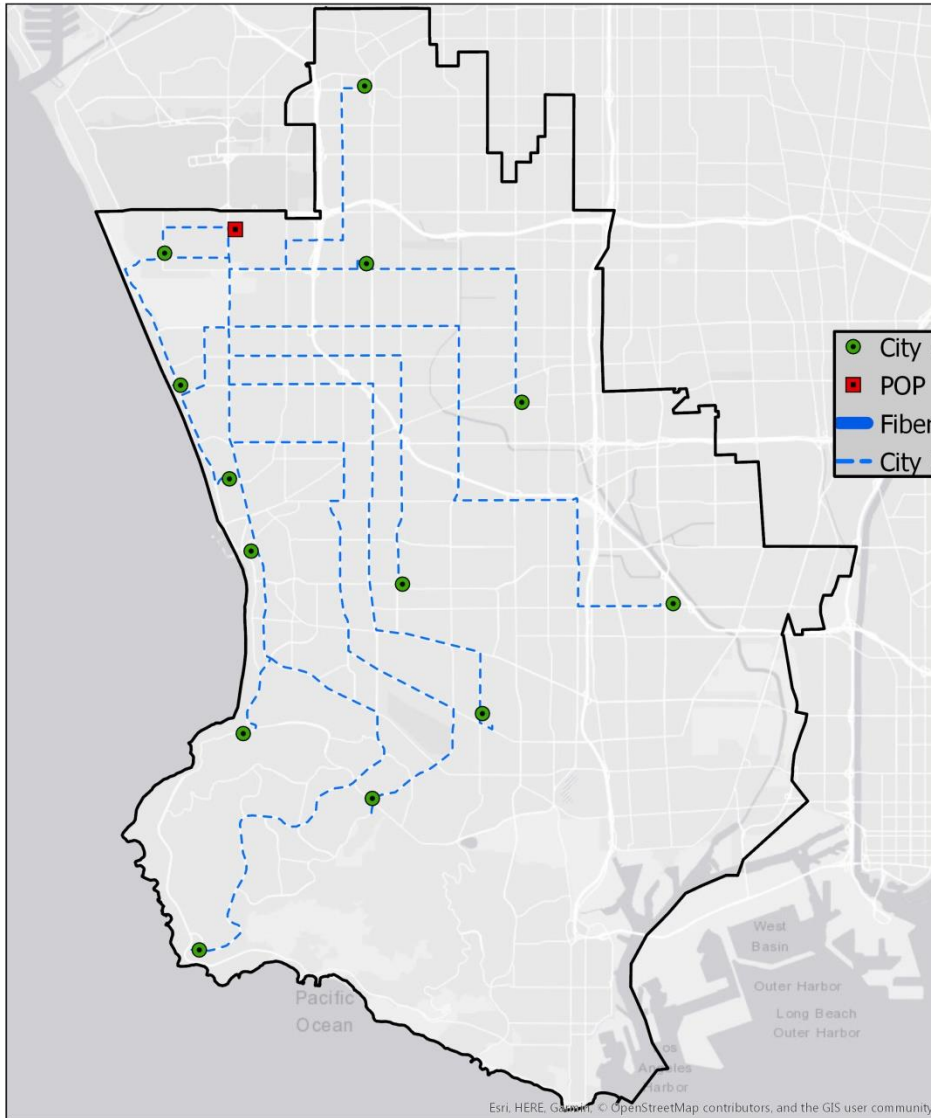


A Word about Fiber Optics

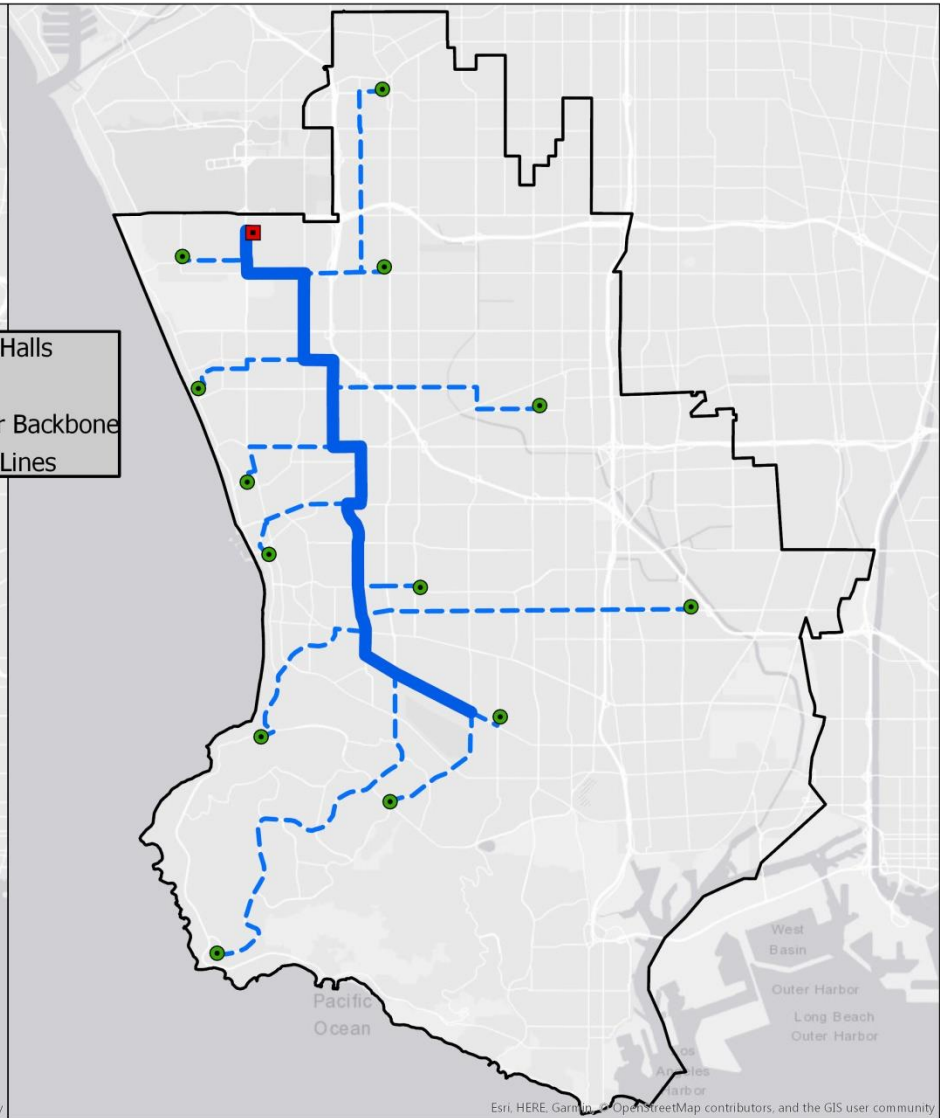
- A single optical fiber is $1/25^{\text{th}}$ the width of a human hair
- A single optical fiber can carry over 3,000,000 full-duplex voice calls or 90,000 TV channels.
- 1,000 fibers can be bundled in 1 cable
- Electronics “light” a “dark” fiber, as needed

Speed (Mbps)	HD Movie (seconds)
200	20.00
500	8.00
1,000 (1 Gig)	4.00
10,000 (10 Gig)	0.40
100,000 (100 Gig)	0.04

Pre-Fiber Optic Backbone



Post-Fiber Optic Backbone



- City Halls
- POP
- Fiber Backbone
- - - City Lines

Immediate Benefits

- Get more for less



- Application: Cloud Computing – data storage, software access, file sharing

Platform for Other Industries

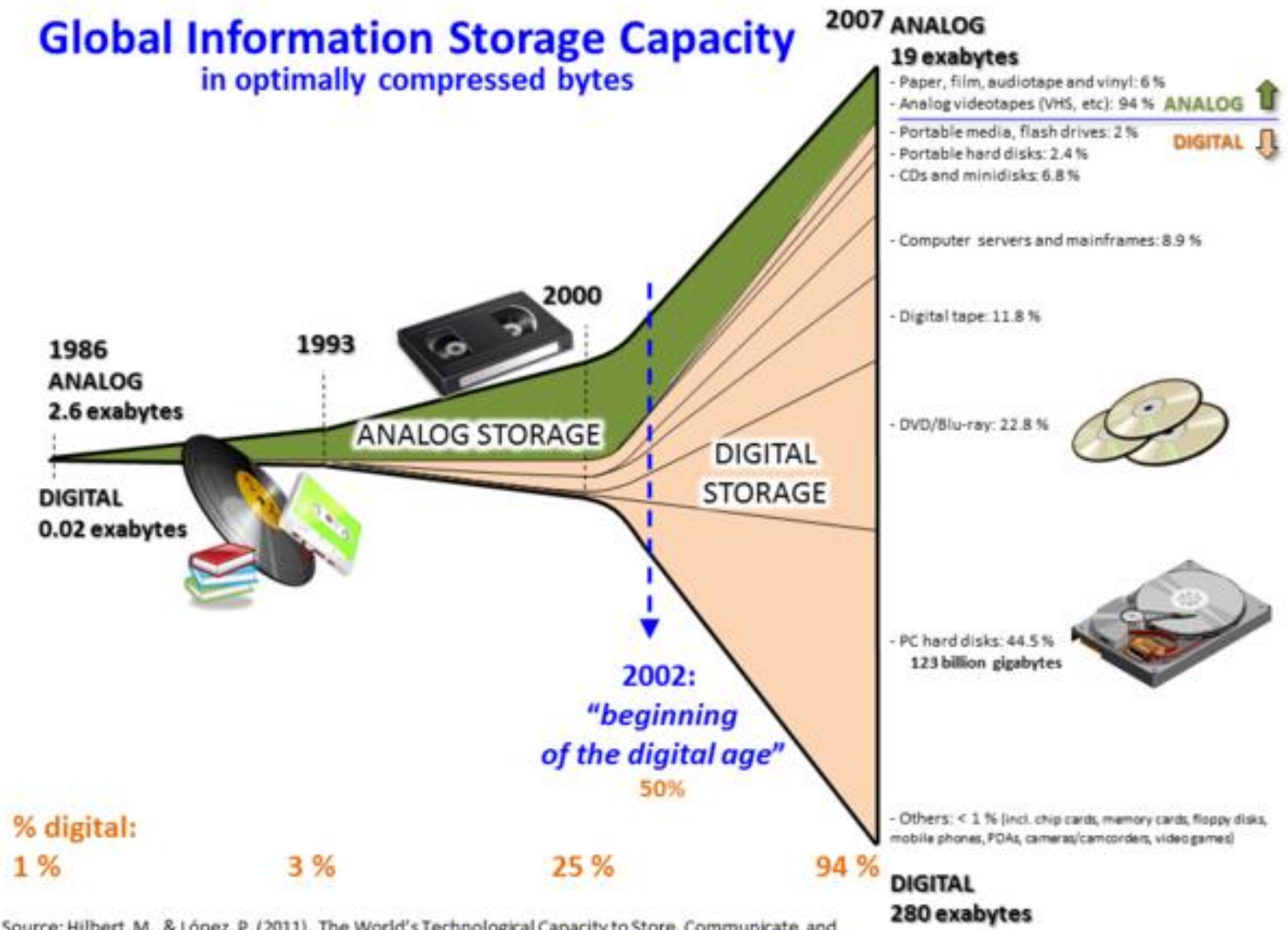
- 5G cellular (depends on extensive fiber infrastructure); 6G development beginning
- Entertainment (streaming HD to VR) – establishes backbone for FTTH
- Connected vehicles (within a few years)
- Internet of Things businesses
- Transmission of Place businesses

Smart Cities

IoT - Big Data

- Cheap and plentiful information- sensing [Internet of things](#) devices such as [mobile devices](#), aerial ([remote sensing](#)), software logs, [cameras](#), microphones, [radio-frequency identification](#) (RFID) readers and [wireless sensor networks](#)
- Trillions of sensors produce massive volumes of data
 - Network Transportation Companies (Uber, Lyft)
 - Smart homes – appliances with sensors
 - Wearables for health monitoring

Global Information Storage Capacity in optimally compressed bytes



Source: Hilbert, M., & López, P. (2011). The World's Technological Capacity to Store, Communicate, and Compute Information. *Science*, 332(6025), 60 -65. <http://www.martinhilbert.net/WorldInfoCapacity.html>

(Seemingly) Ridiculous Examples

- Smart Rat Traps
 - Send real-time data when detecting nearby motion and when the trap has been activated
 - Eliminate need to regularly inspect all traps
- Smart Dumpsters
 - Real time reporting & visual tracking of dumpsters
 - Optimized routing so the waste hauler can focus resources on only the full containers
 - Lower waste removal expenses by 50%.

Large Scale Demonstrations

- Songdo, South Korea
- Union Point, MA (General Electric and MIT)
- Quayside, Toronto (Google)



Municipal Big Data

- Security – cameras in public spaces
- Parking management
- Traffic management (signal control, reverse lanes)
- Free Wi-Fi outside connected buildings
- Water well monitoring
- Asphalt condition monitoring
- Monitor conditions of bridges, buildings, parks, and other venues
- What else????

Transmission of Place

- Distance education
- E-government
- Telecommuting – more telecommuters than transit riders
- Digital medicine
 - Example “Tele-Orthodontics”

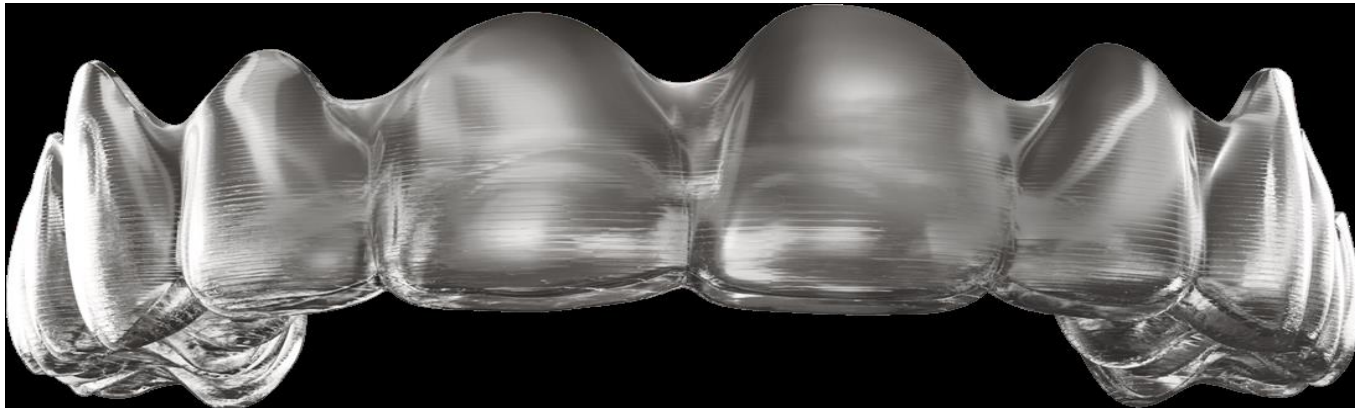
Orthodontics

- Metal braces installed in orthodontist office, multiple check-ups over a year period;
 - \$5,000 to \$8,000



Tele-Orthodontics

- One visit to scan teeth
- Scan analyzed remotely
- 3D print 24 trays of plastic braces, mail
- Monthly selfies to monitor progress
- 6 to 8 months, about \$2,100



Why is the fiber backbone really important?

Business attraction and retention

Citizen satisfaction

Ability to regulate

Cost of operations

Basic infrastructure of the 21st Century