
Driverless Cars and the Future of Transportation

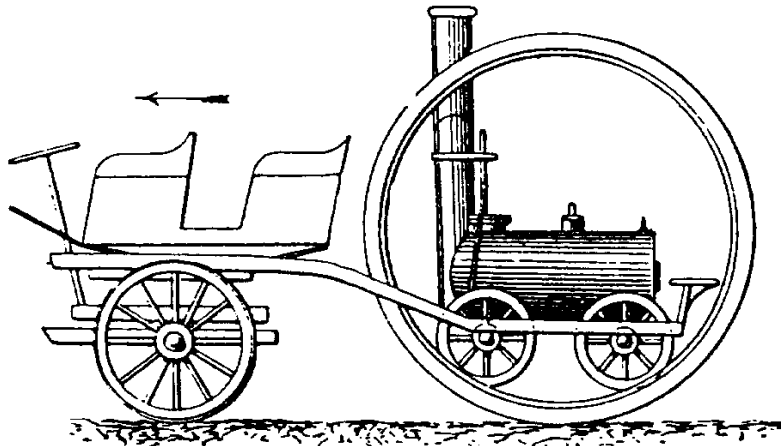
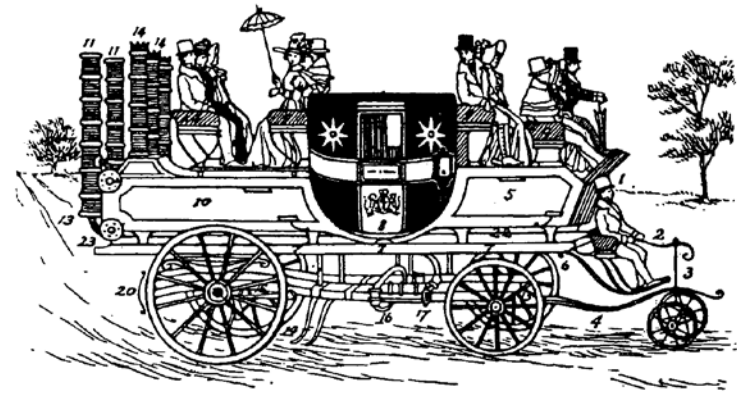
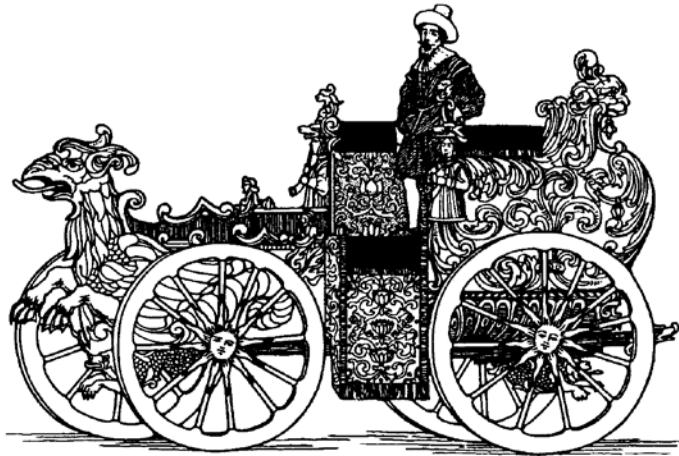
Dr. Michael Hunter



Thoughts:

- This presentation is (hopefully) focused on transportation technology and concepts that might impact the movement of people and goods from the perspective of the “transportation engineer.”
- A few things this is not:
 - Energy (gallons per mile, electric)
 - Mechanical Improvements
 - Marine transportation
 - Aviation (although.....)
 - Going to space
 - Etc.

Everything Old is New Again



Source: Technology Evolution in the Transportation System, Dr. Randall Guensler, 2014

Driverless Car



<https://tctechcrunch2011.files.wordpress.com/2014/05/google-self-driving-car.jpeg>

Assumptions



"Nice, but as long as there are readers there will be scrolls."

http://37.media.tumblr.com/tumblr_m3gsrzgDiG1qav5oho1_1280.png

Vastly Over-Simplified Motivations

What does it cost?

Path of least resistance.



Mixed Fleet



<http://www.collectivedata.com/images/fleetOfCars.jpg>

Safety

SAFETY FIRST!

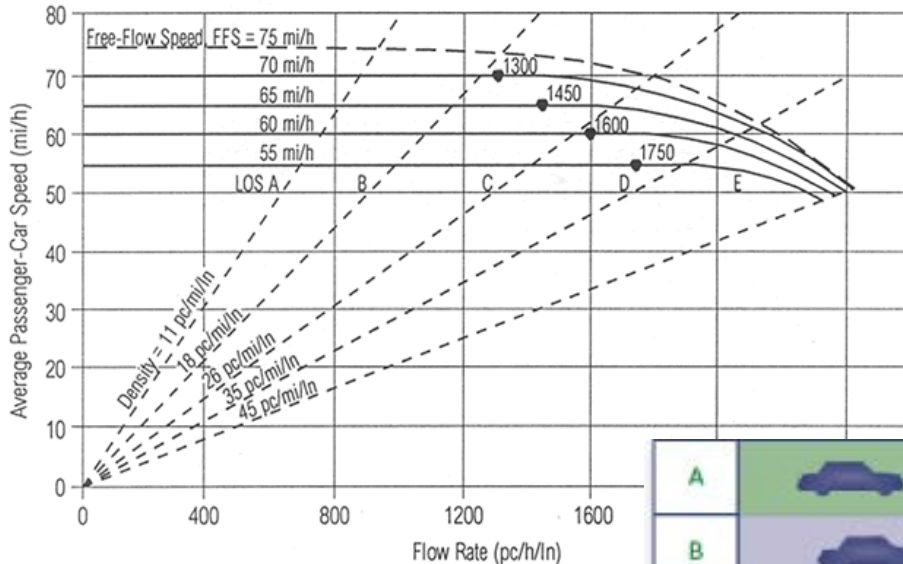
<http://www.adamsindustriesinc.com/12612-2/>

Basic Principles



Capacity: Maximum Sustainable Flow

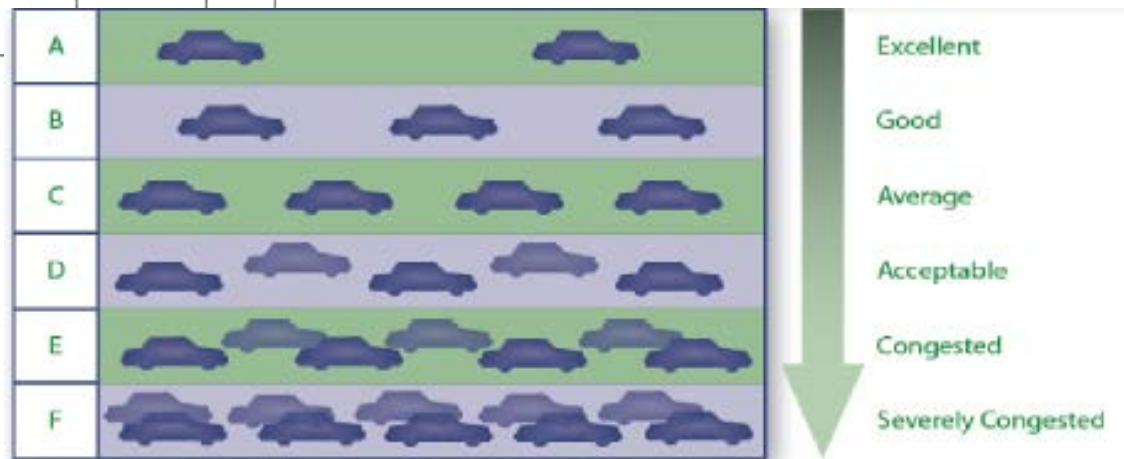
EXHIBIT 23-3. SPEED-FLOW CURVES AND LOS FOR BASIC FREEWAY SEGMENTS



Speed Flow Density Curve from the Highway Capacity and Quality of Service Manual

http://www.ops.fhwa.dot.gov/publications/fhwahop09017/008_section_2.htm

<http://www.clarksvillesmartgrowth.com/Sec3-TransportationAnalysis.htm>



Freeway vs Street



<http://www.clarksvillesmartgrowth.com/Sec3-TransportationAnalysis.htm>



<http://www.clarksvillesmartgrowth.com/Sec3-TransportationAnalysis.htm>

Will potential freeway capacity benefits be constrained by the arterial network grid?

Demand



http://www.slate.com/content/dam/slate/archive/2011/05/1_123_125_123051_2279756_2292807_110526_box_commute_tn.jpg.CR
OP.original-original.jpg



http://www.dailyhaha.com/_pics/daily_commute.jpg

Will the disbenefit of our daily commute greatly decrease?

Demands will Change



<http://www.marketingpilgrim.com/wp-content/uploads/2011/11/grocery-shopping.jpg>



<http://drycleaning-business.com/images/dry-cleaners.jpg>

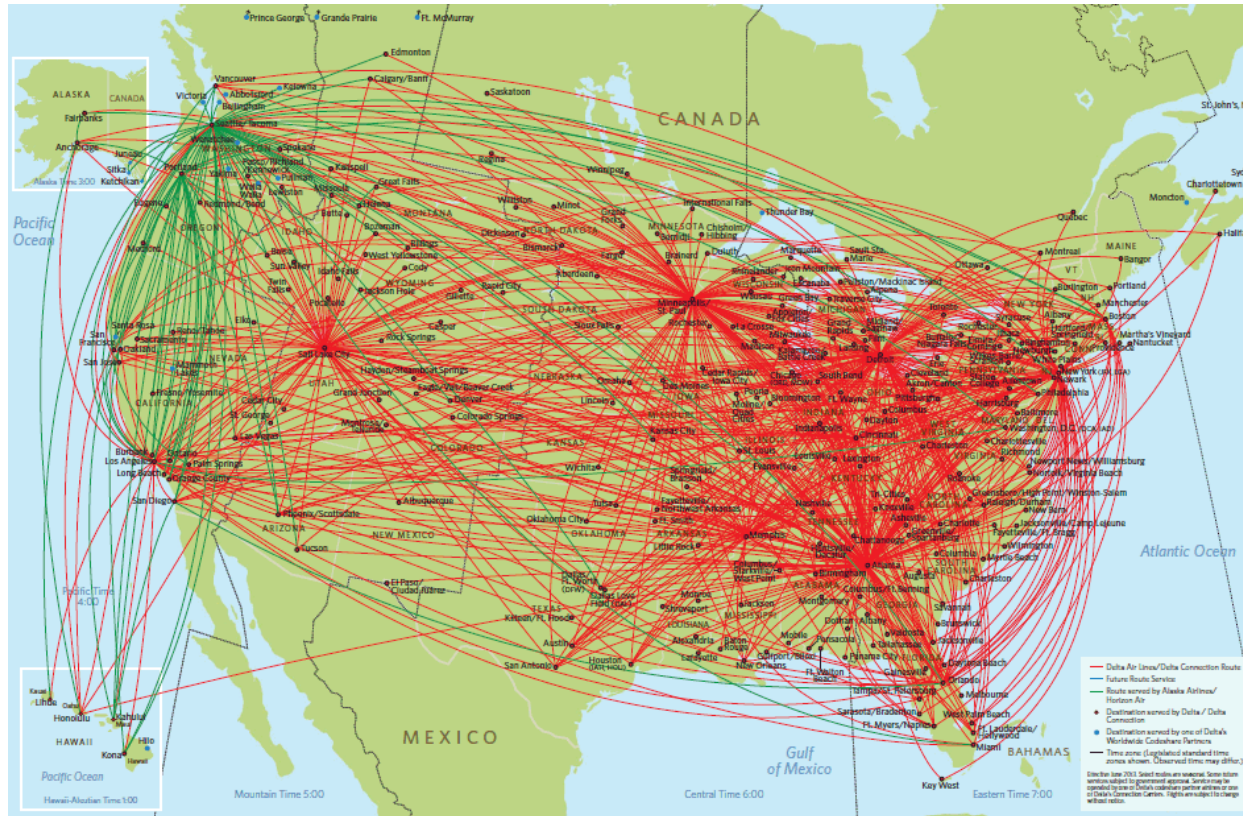


http://etc.usf.edu/clipart/74500/74514/74514_161_d9-20_c_lg.gif

New Business models will emerge for:

- Grocery Shopping
- Dry Cleaning
- Medication pick-up
- At home meal service
- etc.

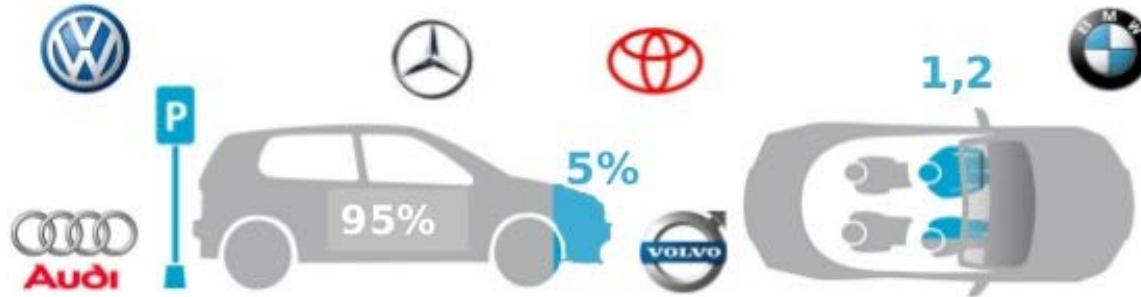
Airline Travel?



Will Airlines still serve short-haul?

Mobility As A Service

Shift from the vehicle ownership



to vehicle "usership"



www.lvm.fi 21.5.2015

Source: Marko Forsblom in Oulu Smart City seminar on Wed 6th May, 2015

<http://www.slideshare.net/Pivilskanius/marko-forsblom-in-oulu-smart-city-seminar-on-wed-6th-may-2015>

RideSharing

INNOVATION IN MOBILITY PUBLIC POLICY SUMMIT



A Summit on Shared-Use Mobility — June 10-11, 2014

Sponsored by the Association for Commuter Transportation, Transportation Sustainability Research Center, Mobility Learning Center and Shared-Use Mobility Center



innovativemobility.org



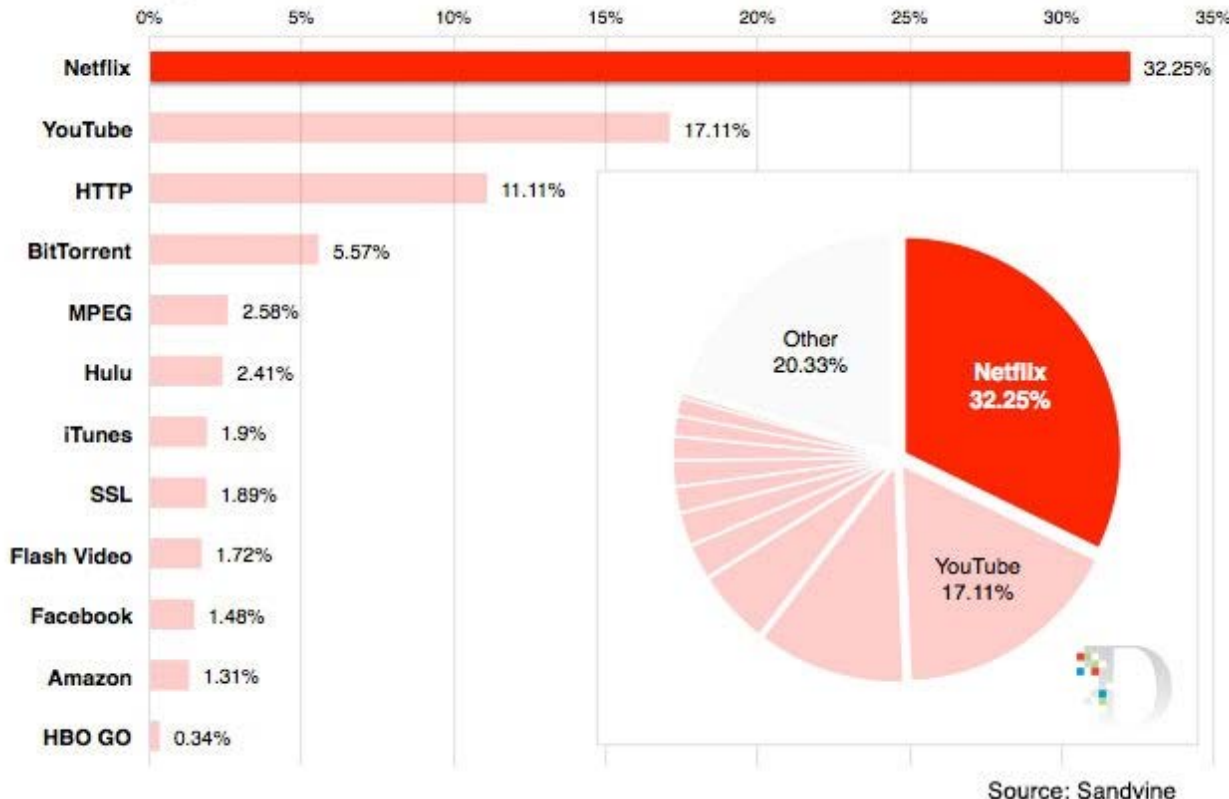
www.shareable.net



www.b3match.eu

Unknown Demands

Top Online Video Downstream Sources - Fixed Access, first half 2013



Netflix accounts for over 30% on internet traffic during peak usage.

Netflix + YouTube nearly 50%

This service did not exist less than 10 years ago!

<http://cdn1.appleinsider.com/sandvine-130514.jpg>

Parking



http://graphics8.nytimes.com/images/2012/01/08/arts/08PARKING_SPAN/08PARKING-articleLarge.jpg



www.mapio.net

How will parking change? Will we still have parking lots?
Could cars “park” by driving around the block?

Eliminate Parking Lots



**City block in Houston, TX
with standard parking**

**Rendering of city block with
equivalent car-sharing spaces**



<http://web.mit.edu/francov/www/citycar>

Aggressiveness

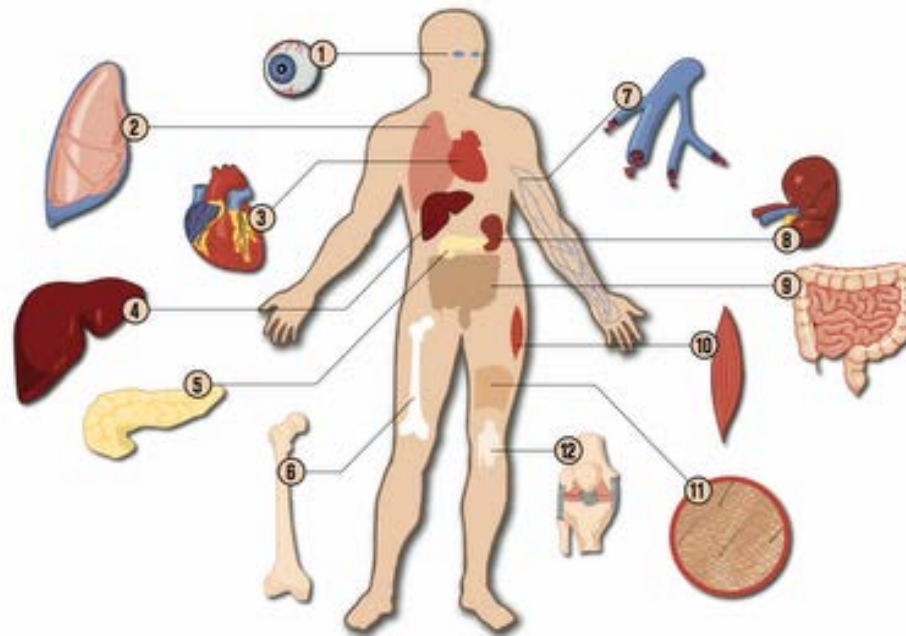


Photo credit: Chris Toth

Law of Unintended Consequences

GIFTS OF DONATION

Organs and Tissues: Their Functions

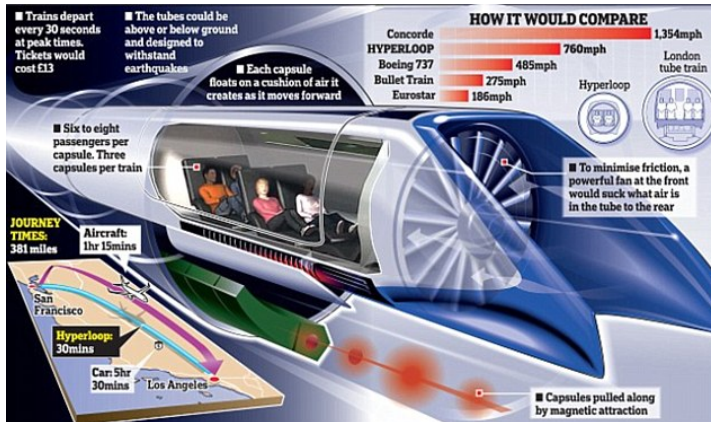


<http://www.adamsindustriesinc.com/12612-2/>

Human-Scale Personal Mobility Devices



Alternate Infrastructure



Hyperloop

http://i.dailymail.co.uk/i/pix/2015/10/23/21/2DB625B800000578-0-image-m-38_1445631166570.jpg

Skytran



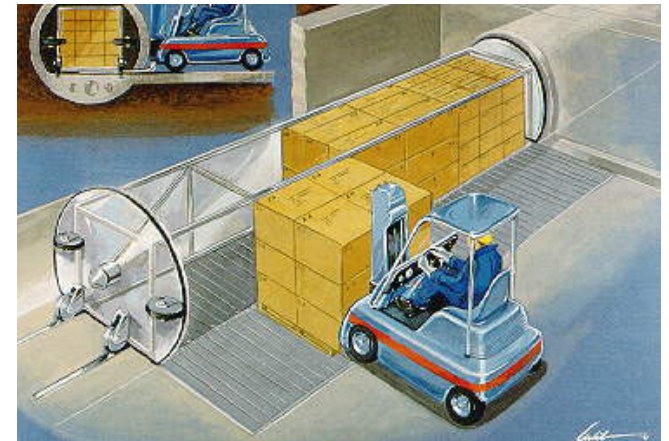
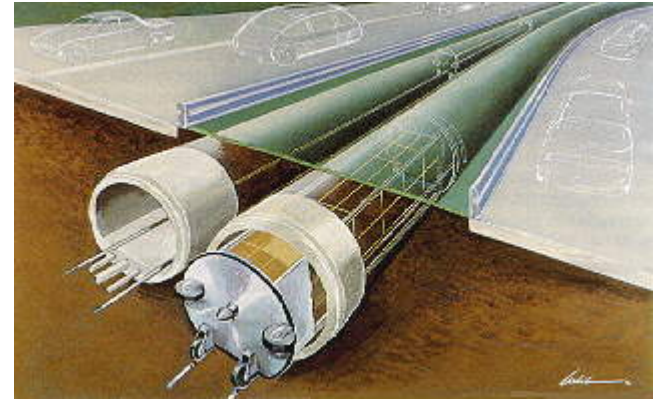
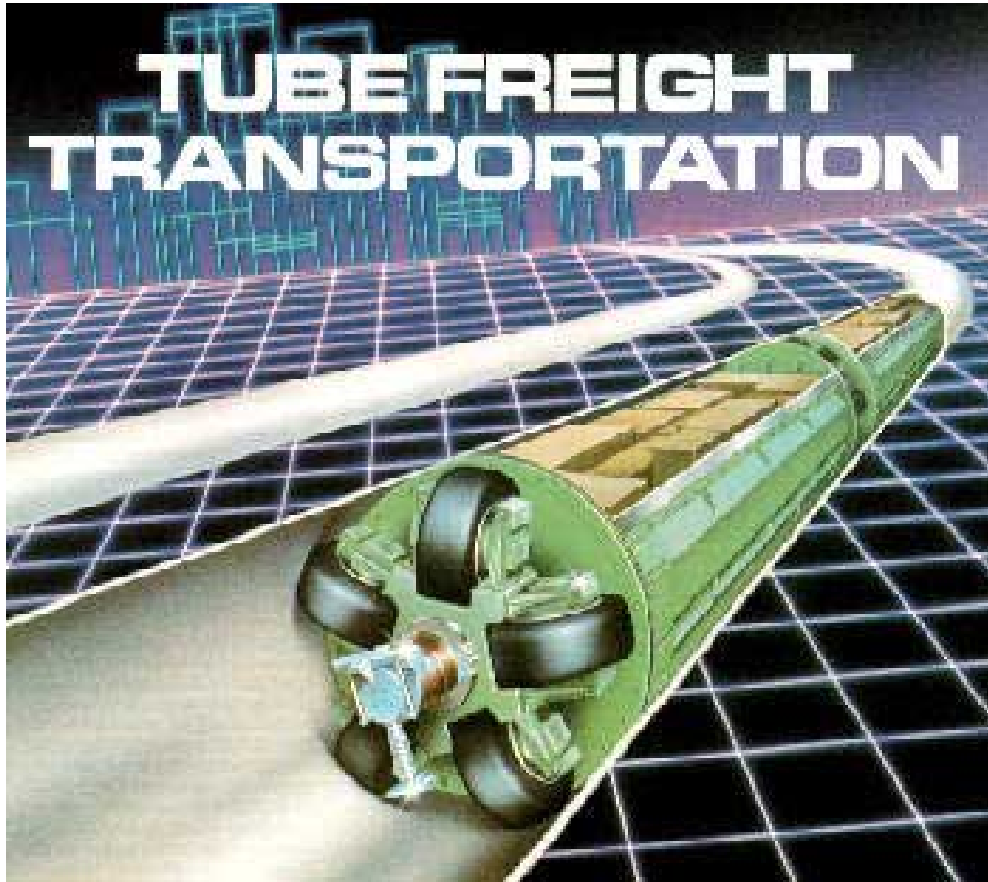
<http://www.skytran.com/images/>



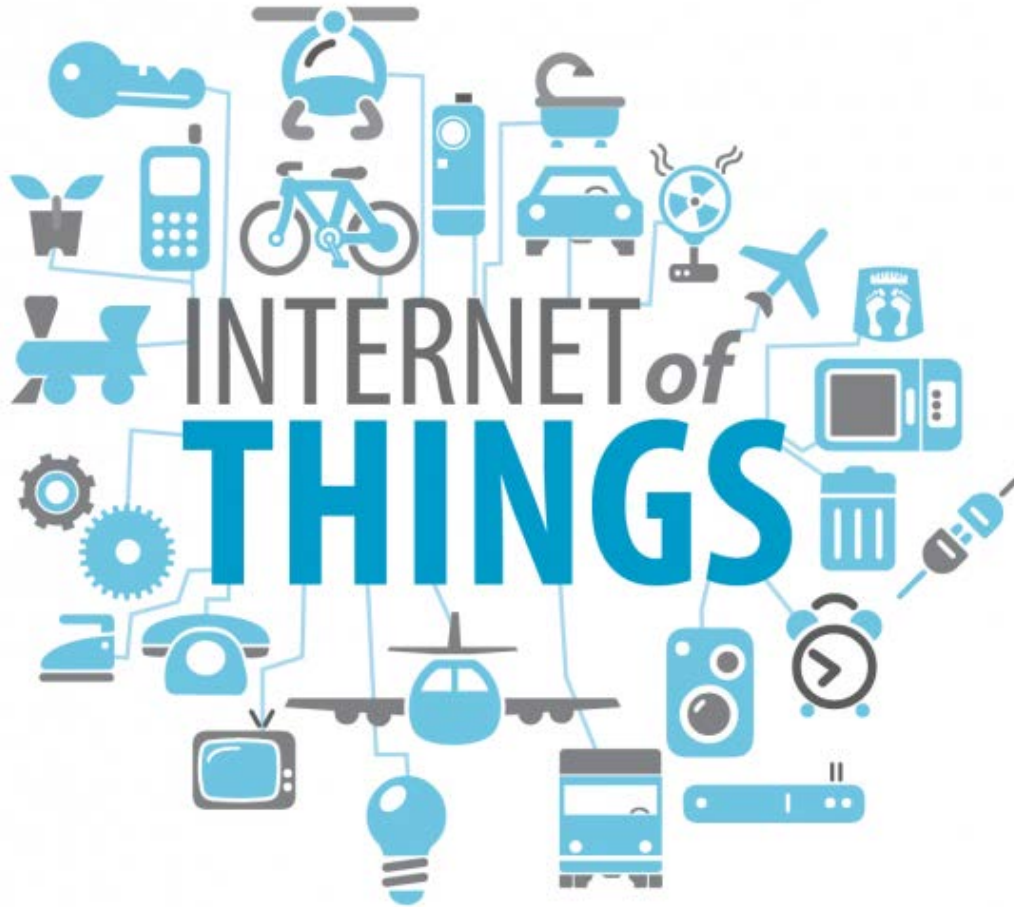
ET3

<http://www.et3.com/>

Tube Freight



Internet of Things



<https://www.linkedin.com/topic/internet-of-things>

Big Data



<http://03e24ad.netsolhost.com/wp-content/uploads/2015/01/bigdata.jpg>

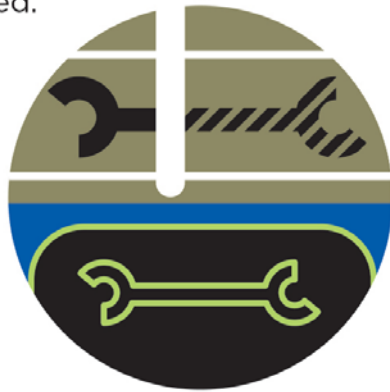
3D Printing

3D Printing

Manufacturers can render precise **3D objects**, such as spare parts and cars—**on demand**.

3D printing will **disrupt supply chains** as manufacturing becomes decentralized.

The first **3D printed car** was created in 2014.



“3D printing has the potential to disrupt traditional supply chains and counteract the growth of imports by reducing the need for large-scale manufacturing, transportation, and storage.”

Source: www.dot.gov/beyondtraffic

Drones



Source:<http://media.giphy.com/media/jxdzvLxmfNxt/giphy.gif>



Source:[http://cms.ukintpress.com/UserFiles/In%20Flight\(2\).jpg](http://cms.ukintpress.com/UserFiles/In%20Flight(2).jpg)

And....



<https://youtu.be/fCjsUxbNmls?t=102>

www.playbuzz.com

Yes, Flying Cars

Moeller Air Car



“Self-flying aircraft is so much easier than what the auto companies are trying to do with self-driving cars” – Paul Moeller

2016
Volocopter
 Maker: E-vo
 Cost: \$280,000; seats: 2

Prototypes have already flown. It's all-electric for now but will be sold as a hybrid to increase flight times.

Looks like a helicopter but makes far less noise

Charges in two hours

Pilots use a joystick and clever software to fly

Weighs 992 pounds

18 propellers—because can you ever have enough?

ILLUSTRATIONS BY ARMANDO VEVE, DATA COMPILED BY BLOOMBERG

2018-19
AeroMobil 3.0
 Maker: AeroMobil
 Cost: \$400,000+; seats: 4

This is a true flying car. It can cruise down the road and take off at a moment's notice as the wings spread out.

Two football fields of distance is enough for liftoff

Needs just a few hundred meters to land

Will be able to fly from, say, New York to Toronto

Fits in a standard parking space and runs on gasoline

Will start taking orders this year

Built in Slovakia

ILLUSTRATIONS BY ARMANDO VEVE, DATA COMPILED BY BLOOMBERG

Other Flying Cars in Development

2026
The TF-X
 Maker: Terrafugia
 Cost: \$120,000; seats: 4

Still in the early stages of development, this flying car should have a range of 500 miles and cruise as fast as 200 mph.

Based in Woburn, Mass.

Full-vehicle parachute included, just in case

Launch date*

Prototype named Transition has already flown

*Launch dates obtained from companies. Handle with care.

ILLUSTRATIONS BY ARMANDO VEVE, DATA COMPILED BY BLOOMBERG

Source: <http://www.bloomberg.com/news/articles/2016-06-09/welcome-to-larry-page-s-secret-flying-car-factories>

Martin Jetpack

- Classified as an 'experimental ultra-light airplane'
- Powered by a gasoline 200- horsepower engine
- Twin ducted fans provide lift
- Max altitude is 8000 feet
- Max speed is 63 mph
- Range is 31 miles
- Includes a parachute for emergencies



Ford Vehicle Technology Evolution



1915 Ford Model T



1930 Ford Model A



1940 Ford DeLuxe



1964 Ford Mustang



1964 Ford Maverick



2005 Ford Explorer

What does it mean?



<http://kmconstruction.net/wp-content/gallery/highways-and-infrastructure/Highway-10.jpg>



Photo Credit: Michael Hunter



<http://freearchitecture.org.uk/wp-content/uploads/2011/11/ChinaRoads.jpg>

Will *New Infrastructure* be needed?
Will *Design Standards* need to be revised?
New urban planning?
What is acceptable operations?
What will be the vehicles & modes?
“Should we build that” lawsuits?

30 Year Traffic Projection



Discussion?

Questions?