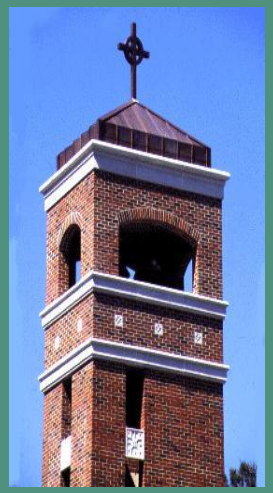


Introduction to MIS

Global and Mobile Information Systems

Learning Objectives

- Discuss the reasons for globalization and for using global information systems, including e-business and Internet growth
- Describe global information systems and their requirements and components
- Explain the types of organizational structures used with global information systems
- Discuss obstacles to using global information systems

Why Go Global?

- Ability to sell products/services globally
- Large global organizations can reduce costs in purchasing, manufacturing, and distribution
  - Access to cheaper labor and materials for product production
- Expansion of global markets
  - Success requires understanding:
    - Language and culture
    - Customs and laws
    - Technological issues
    - Local business needs and practices
- What is I18N and/or L12N ?

Don’t look ahead …

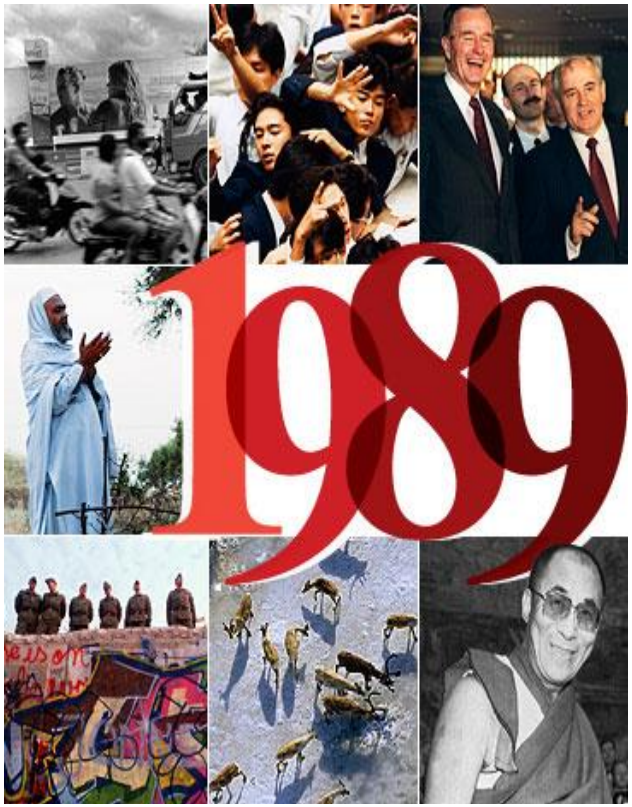
Globalization

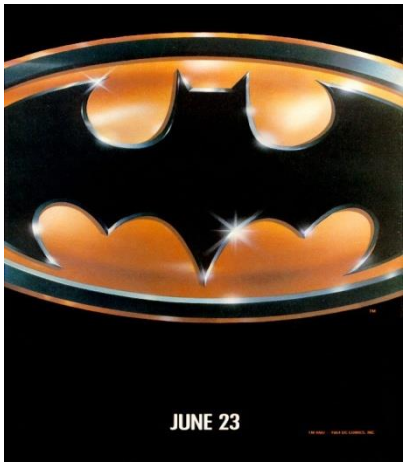
- According to Computerworld: "Globalization is the marketing and selling of a product outside a company's home country
- A similar term to 'globalization' is 'internationalization' (shortened to **I18N** in today's Internet jargon)
- 'Localization' (shortened to **L12N** in Internet jargon) is the recommended method (from a business perspective) of implementing a global web presence

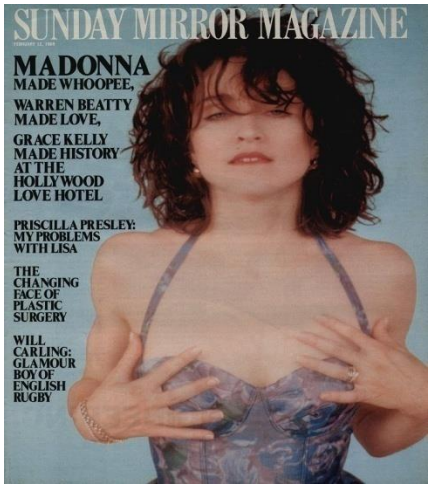
"National Convergence"

- Since the end of the Cold War (tearing down of the Berlin wall), the world has been rushing toward ever-higher levels of national convergence, with capital markets, business regulation, trade policies, and the like becoming similar
- It's an era of Internet (1994), NAFTA (1992), World Trade Organization (1995), the Euro (1999), the emergence of China and much more
- **"The world has not witnessed such a dramatic change in business since the Industrial Revolution"**


CITY PRICES
London Herald
LATE EDITION
SATURDAY 11th NOVEMBER 1989
BERLIN WALL TUMBLES
'Beginning of the End' for Communism
Germany Re-unified
Breaching the Wall
OTHER NEWS


1989


JUNE 23


SUNDAY MIRROR MAGAZINE
MADONNA
MADE WHOOPEE,
WARREN BEATTY
MADE LOVE,
GRACE KELLY
MADE HISTORY
AT THE
HOLLYWOOD
LOVE HOTEL
PRISCILLA PRESLEY:
MY PROBLEMS
WITH LISA
THE
CHANGING
FACE OF
PLASTIC
SURGERY
WILL
CARLING:
GLAMOUR
BOY OF
ENGLISH
RUGBY

- What % of the world's online population (internet) is outside of the US ?

- For today's US domestic average web site, what % of the "hits" come from foreign visitors ?

- What % of US small to mid size companies export overseas ?

Wait….

?

Don’t look ahead, until you have your answer !

Global "Factoids"

- About 80% of the world's online population is residing outside of the United States
- Today's average web site gets 30% of its traffic from foreign visitors
- However, today only 1% of small and midsize American businesses export overseas – huge growth potential once smaller companies can understand global business

Foreign Subsidiaries

- Foreign subsidiaries of US companies are outperforming their domestic branches (in regard to profits) by a ratio of ?????
  - 2 to 1
  - 3 to 1
  - 5 to 1
  - 10 to 1
  - Domestic branches are performing better

Wait….

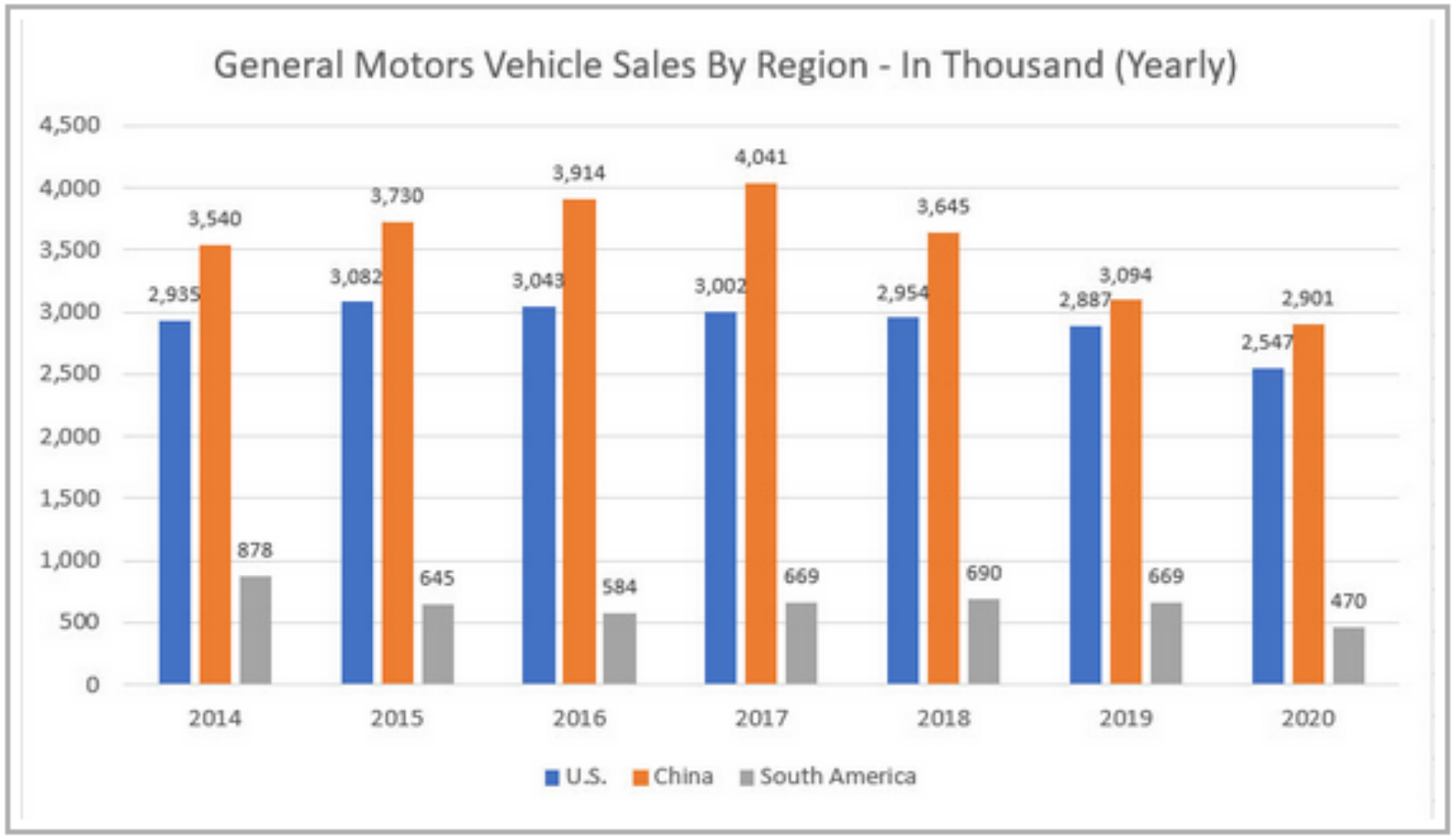
?

Don’t look ahead, until you have your answer !

Foreign Subsidiaries (con't)

- In the last decade, domestic profits of US companies increased about 20% while those of their foreign subsidiaries increased almost 200% (10 to 1)
- Thus today's business needs are forcing organizations to do business outside of their home country, and/or using foreign resources, and often in multiple countries

Is GM a US Company ?



US Companies ?

- **Budweiser**
- **Alka-Seltzer**
- **Good Humor**
- **Gerber**
- **7-Eleven**

Wait….

?

Don’t look ahead, until you have your answer !

US Companies ? (con't)

- Budweiser is owned by Anheuser-Busch InBev N.V., a Belgian and Brazilian company with headquarters in Leuven, Belgium. Its U.S. operations include managing 12 breweries plus hops farms, malt plants, barley elevators and a rice mill
- Alka-Seltzer is owned by Bayer AG, a German pharmaceutical company. It operates multiple sites all over the U.S. for administration, marketing, research and development and manufacturing
- British and Dutch Good Humor-Breyers, operates out of Unilever's U.S. headquarters in Englewood Cliffs, N.J.
- In 1994 Gerber merged with Sandoz Laboratories, which would merge with another company in 1996 to form Novartis. In 2007, the company sold off Gerber to the Swiss multinational Nestlé for $5.5 billion
- Perhaps no convenience store chain in the U.S. is as well-known as 7-Eleven. It operates over 7,000 stores throughout the country, but nearly twice that amount is found in Japan, home of Seven & I Holdings Co., owner of the entire chain

Global Cities

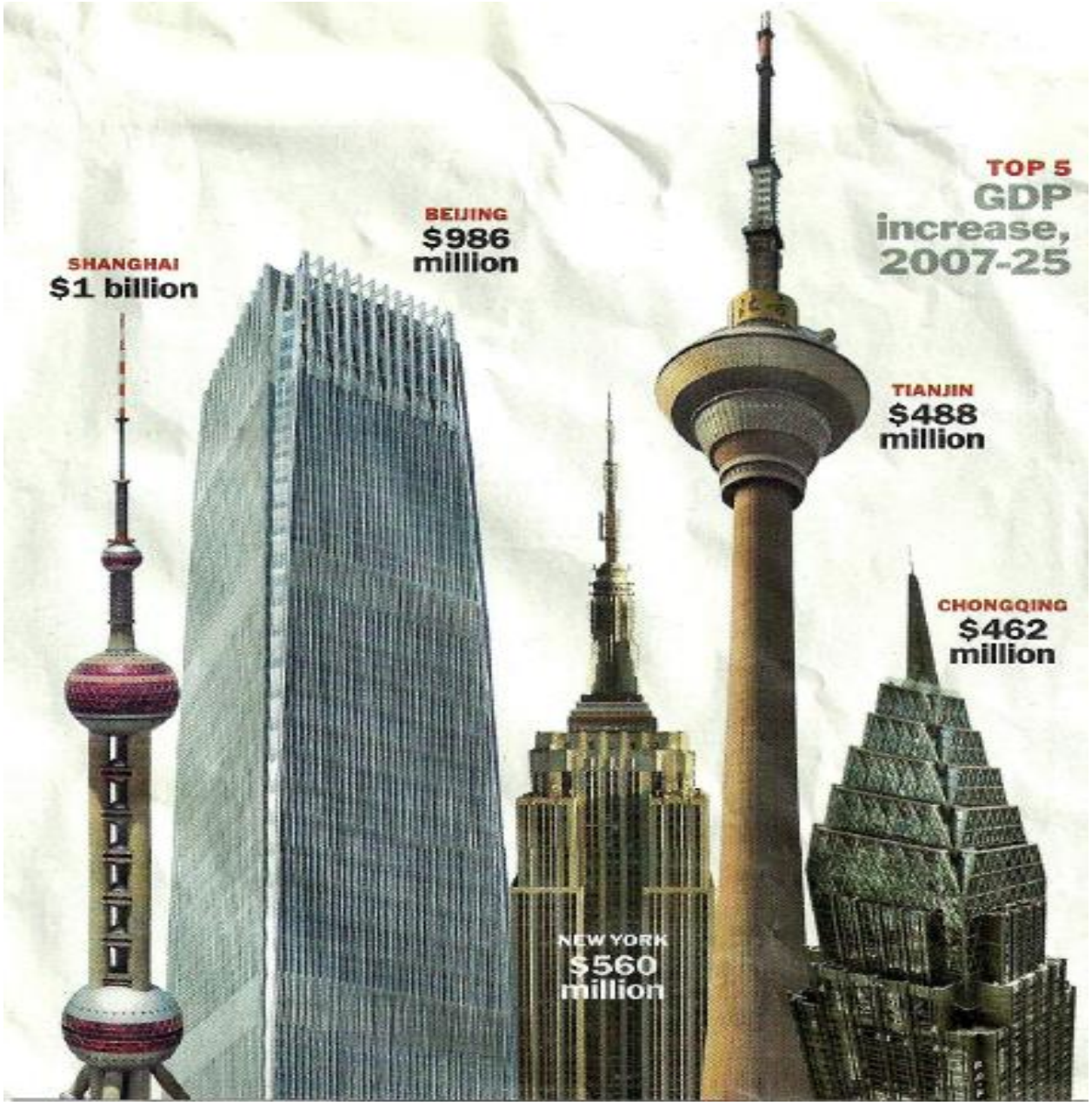
- What are the largest cities in the world ?

Wait….

?

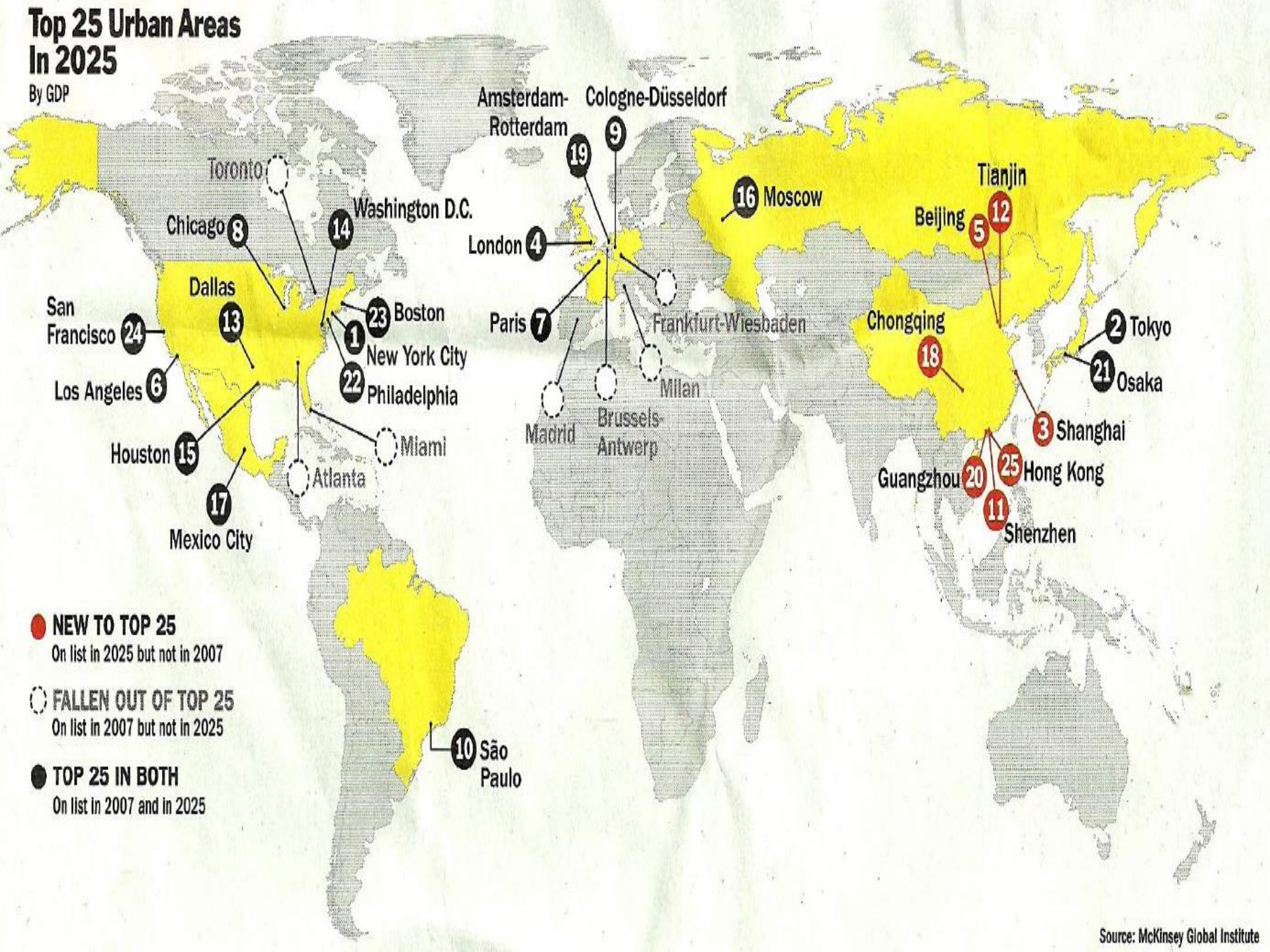
Don’t look ahead, until you have your answer !

City	Nation	Image	Population		
			City proper	Metropolitan area	Urban area[7]
Chongqing	China		30,165,500[8]		8,189,800[a]
Shanghai	China		24,256,800[10]	24,750,000[11]	23,416,000[b]
Delhi	India		21,678,794[12]		21,753,486[13]
Beijing	China		21,516,000[14]	24,900,000[15]	21,009,000
Mumbai	India		21,247,844[13]	21,771,200	22,748,395[13]
Lagos	Nigeria		16,060,303[c]	21,000,000[16]	13,123,000
Chengdu	China		16,044,700[17]	10,376,000	
Karachi	Pakistan		14,910,352[20][d]	24,000,000	
Guangzhou	China		14,043,500[24]	44,259,000[25]	20,800,654[26]
Istanbul	Turkey		14,025,000[27]	13,520,000	14,657,000[27]
Tokyo	Japan		13,513,734[28]	37,843,000	36,923,000[29]


TOP 5
GDP
increase,
2007-25
BEIJING
$986
million
SHANGHAI
$1 billion
TIANJIN
$488
million
CHONGQING
$462
million
NEW YORK
$560
million

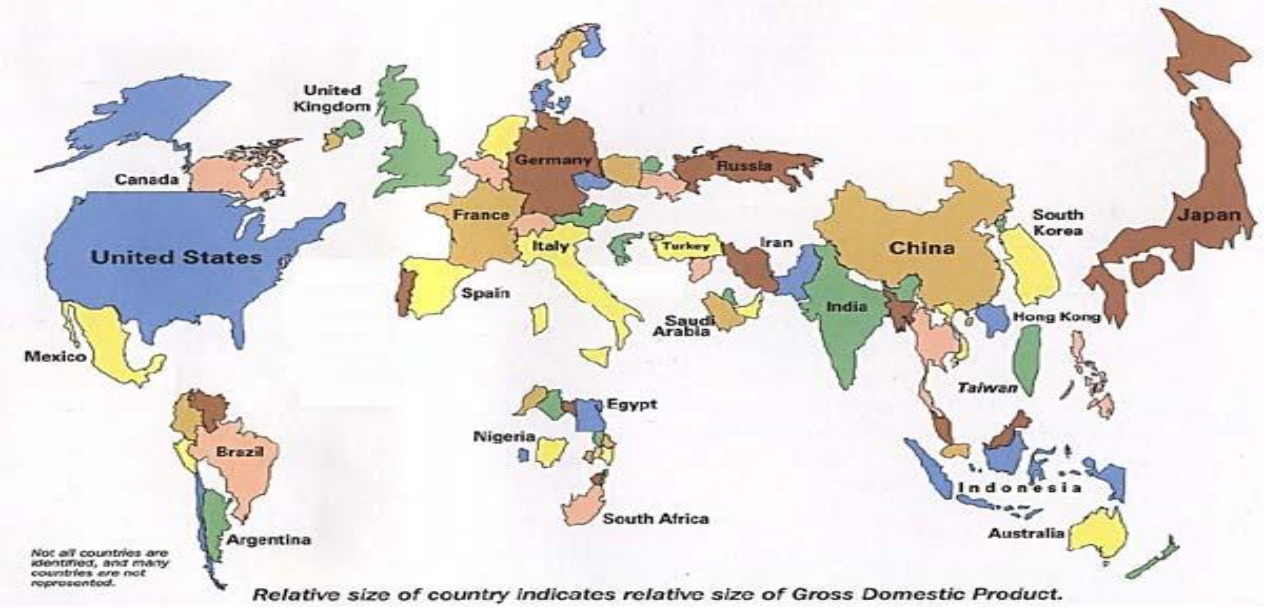
Top 25 Urban Areas In 2025

By GDP



Source: McKinsey Global Institute

- Which country has the highest average household income ?
- Which country has the highest per capita GNP?



Wait….

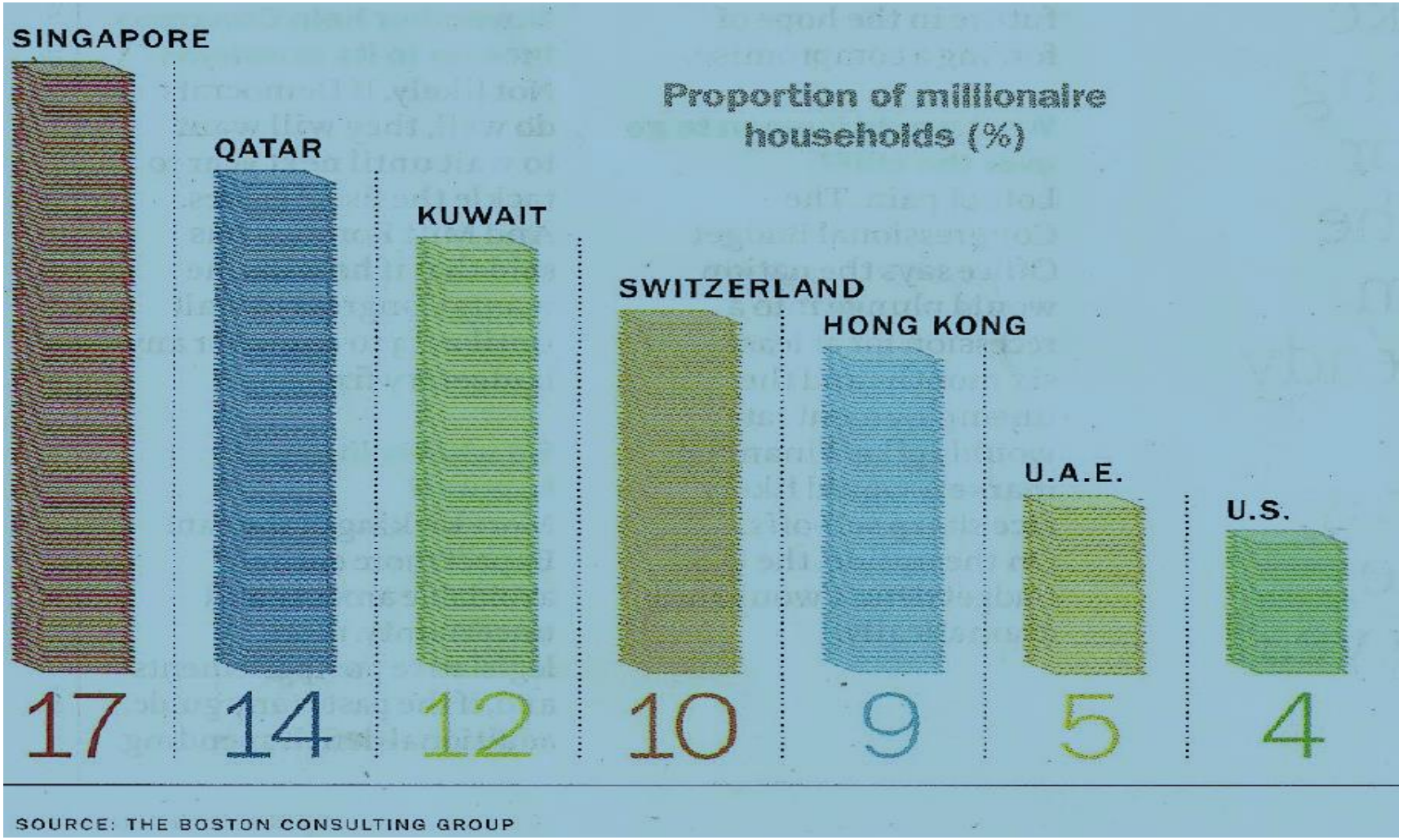
?

Don’t look ahead, until you have your answer !

Global Household Income

- Switzerland has the highest household income at $62,000 (US is at $48,000)
- Luxemburg has the highest per capita GNP at $78,000; Norway is second at $52,000 (US is at $44,000)
- The number of millionaires is growing faster in China, Russia, and India than the US
- Fifteen years ago, the U.S. was 70 % of the global market cap, today it's 28 % and falling; blossoming markets are India, China, Latin/South America, and the Middle East

Proportion of Millionaires



US Standard of Living

- US living standards are gradually deteriorating
- Early baby boomers--those now aged between 58 and 67--were the last generation to enjoy higher living standards than the one that came before
- For those younger than 58, upward mobility has slowed dramatically
- Currently the odds of an ambitious young bootstrapper rising from humble origins are better in many other countries than they are in the United States
- The United States only ranks 13th out of 17 developed nations by one measure of economic mobility
- Young Americans enjoy better economic mobility than their counterparts in Slovenia, Chile, Italy and the U.K., but young workers have a better chance of moving up in 12 other countries, including Sweden, Denmark, France, Spain, Germany, Australia and Canada

WORLD INTERNET USAGE AND POPULATION STATISTICS

World Regions	Population (2006 Est.)	Population % of World	Internet Usage, Latest Data	% Population (Penetration)	Usage % of World	Usage Growth 2000-2005
Africa	915,210,928	14.1 %	**23,649,000**	2.6 %	2.3 %	423.9 %
Asia	3,667,774,066	56.4 %	**380,400,713**	10.4 %	36.5 %	232.8 %
Europe	807,289,020	12.4 %	**294,101,844**	36.4 %	28.2 %	179.8 %
Middle East	190,084,161	2.9 %	**18,203,500**	9.6 %	1.7 %	454.2 %
North America	331,473,276	5.1 %	**227,470,713**	68.6 %	21.8 %	110.4 %
Latin America/Caribbean	553,908,632	8.5 %	**79,962,809**	14.7 %	7.8 %	350.5 %
Oceania / Australia	33,956,977	0.5 %	**17,872,707**	52.6 %	1.7 %	134.6 %
WORLD TOTAL	6,499,697,060	100.0 %	**1,043,104,886**	16.0 %	100.0 %	189.0 %

NOTES: (1) Internet Usage and World Population Statistics were updated for June 30, 2006. (2) CLICK on each world region for detailed regional information. (3) Demographic (Population) numbers are based on data contained in the world-gazetteer website. (4) Internet usage information comes from data published by Nielsen//NetRatings, by the International Telecommunications Union, by local NICs, and other other reliable sources. (5) For definitions, disclaimer, and navigation help, see the Site Surfing Guide. (6) Information from this site may be cited, giving due credit and establishing an active link back to www.internetworldstats.com.

- As a country, where does the US rank in the world in terms of internet penetration ?

Wait….

?

Don’t look ahead, until you have your answer !

- **The U.S. is 20th in the world in Internet penetration (Luxembourg has passed us)**

Internet Usage

- China about 750 million users
- USA about 250 million users

- China 55% of population have Internet
- USA 76% of population have Internet
- China Netcom offers broadband service at $10 a month
- **China Mobile is the world's largest telecom company and is now <u>adding 5 million customers a month</u> !**
- • "My friends all agree - no Internet, no life." Chinese student (age 19)
  - Source: USA Today

Country or area	Internet users	Rank	Percentage
China	746,662,194	1	53.20%
India	391,292,635	2	29.55%
United States	245,436,423	3	76.18%
Brazil	123,927,230	4	59.68%
Japan	117,528,631	5	92.00%
Russia	110,003,284	6	76.41%
Mexico	75,937,568	7	59.54%
Germany	73,436,503	8	89.65%
Indonesia	66,244,991	9	25.37%
United Kingdom	62,354,410	10	94.78%
Philippines	57,342,723	11	55.50%
France	55,413,854	12	85.62%
Nigeria	47,743,541	13	25.67%
South Korea	47,094,267	14	92.72%
Turkey	46,395,500	15	58.35%
Vietnam	43,974,618	16	46.50%
Iran	42,731,675	17	53.23%
Egypt	37,519,531	18	39.21%
Spain	37,337,607	19	80.56%
Italy	36,442,438	20	61.32%
Thailand	32,710,169	21	47.50%
Canada	32,602,776	22	89.84%
Argentina	30,758,972	23	70.15%
South Africa	30,248,355	24	54.00%

Alibaba

- China's Alibaba possibly has more e-commerce transaction volume (in currency) than Amazon and eBay combined:
  - About $1 trillion
  - Alibaba is partially owned by Yahoo and Japan's Softbank

Globalization Challenge

- “Web site globalization is a big challenge and requires constant vigilance to avoid cultural gaffes”.
- Today 1/2 out Fortune’s 100’s Web sites are available only in English
- In our rush to get on the WWW, we sometimes forget that WW is for “World Wide”
- Wal-Mart has a global work force of over 1 million and runs more than 1000 of its 3500 retail outlets in foreign countries; yet its web site (Wal-mart.com) is only for Americans.

Global Dimensions

- ‘Localization’ (L12N) considers five global dimensions:
  - cultural (language, customs, demographics, etc.)
  - geographic (country/region, date/time, etc.)
  - functional (logistics, manufacturing, sales, etc.)
  - regulatory (laws, tax, confidentiality, etc.)
  - economic (currency, measures, tariffs, etc.).

Language

- Since 2002 a majority of Internet users speak primarily languages other than English
- Currently the breakdown is roughly
  - 50% English
  - 9% Japanese
  - 6% German
  - 6% Spanish
  - 5% Chinese
  - 4% French
  - 15% other
- That means if you do not localize your web site soon, you will be ignoring half of the world

- For what % of the world population is English the native language ?

Wait….

?

Don’t look ahead, until you have your answer !

- What country has the most people who speak English ?

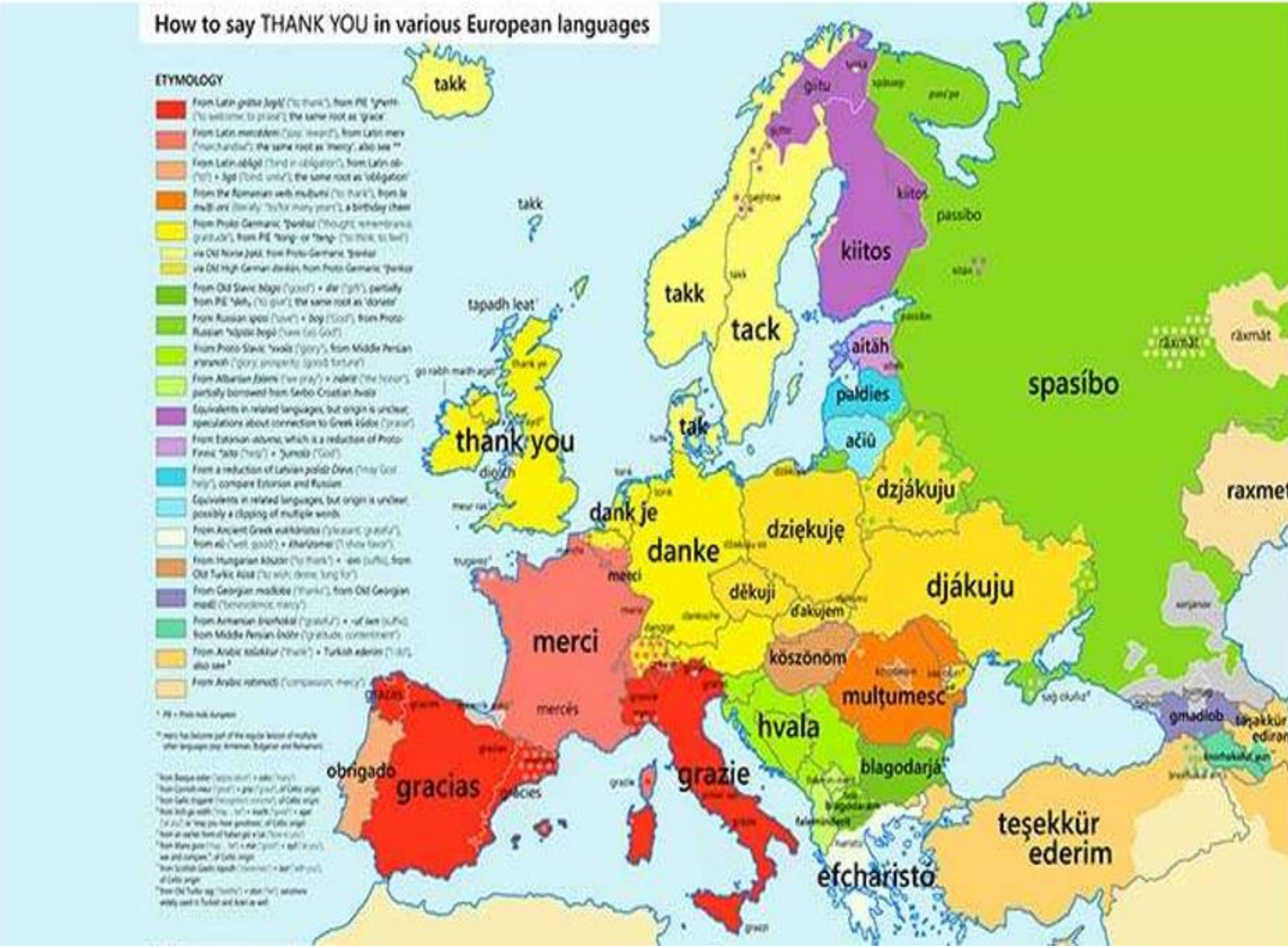
Wait….

?

Don’t look ahead, until you have your answer !

But, everyone knows English…

- Now its true that for a number of years most of the Internet community can still understand English, but overall English is the native language to only 8% of the world
- China has the most English speaking people
- Most users in foreign countries prefer content in their own language; for example, 75% of users in China and Korea have such a preference
- **It was found that visitors spend twice as long, and are three times more likely to buy from a site in their native language**


How to say THANK YOU in various European languages
ETYMOLOGY
takk
takk
tapadh leat
thank you
takk
tack
kiitos
passibo
aitäh
paldies
ačiū
spasibo
ràxmat
raxmet
tak
dank je
danke
dziękuję
dzjákuju
djákuju
děkuji
ďakujem
merci
merci
köszönöm
mulţumesc
gmadlob
tąşakkür edirəm
hvala
blagodarja
grazie
gracias
obrigado
mercés
efcharistó
teşekkür ederim

Language Multiplicity & Dialects

- In some countries/regions multiple languages are used. Belgium has both French and Dutch. Canada both English and French. In Switzerland, German, French, and Italian are used.
- Language dialects prevail. As George Bernard Shaw once said, “England and America are two countries divided by a common language.”
- One cannot use “Classic German” in Germany, Austria, or Belgium; since they all speak a different German. Canadian French is different from French in Paris, just as Spanish in Mexico City is different from Spanish in Barcelona.
- In some regions there may be one spoken language, but several writing systems for it such as Japan.

“Locale”

- The combination of language and dialect is called a “locale” (at least, from an IT perspective)
- When you install an operating system on your computer, you typically specify a locale
- Then to view content that has been localized for a non-English audience, you have to have your computer properly equipped with the correct scripts (characters and glyphs/symbols).
- The most popular scripts are: Roman (English and romance languages), Kanji (China, Japan, and other Asian countries), Cyrillic (Russia and Eastern Europe), Arabic (Middle East), Kana (Japan), Devanagari (India), Korean, Thai, Telugu (India), Hebrew, Burmese, and Greek.

Language Translation

- Of course the first task in localizing your web pages is to translate them into them the target language/dialect.
- You can do this by
  - Hiring a translator
  - Using a company providing translation services
  - Using a computer based translation product or service

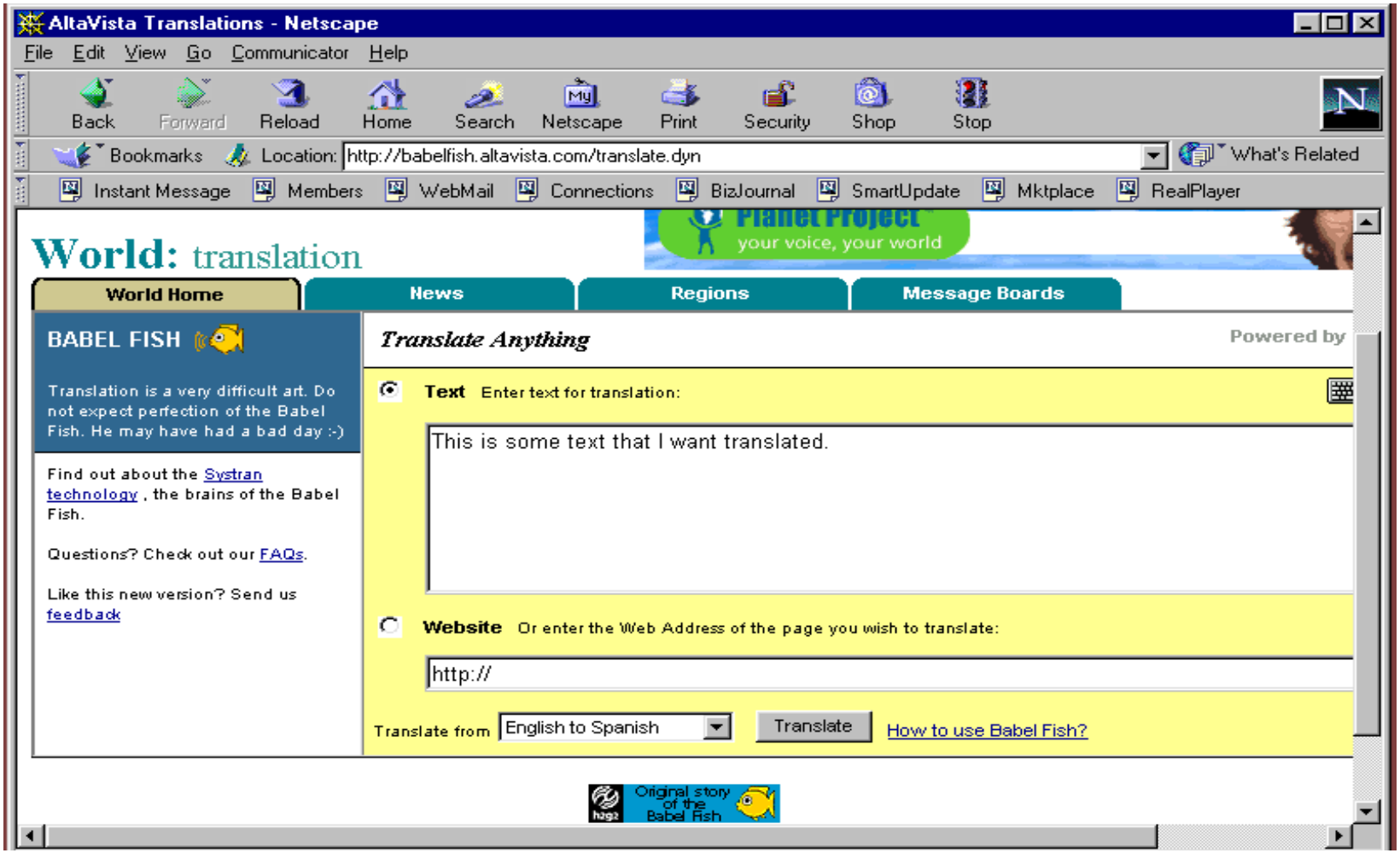
Translators

- Hiring a translator will provide the best localization, but is far more costly than the automatic methods
- Translators can easily be found in the Aquarius directory (http://aquarius.net), Glen's Guide (www.gleensguide.com), or Expert Central (www.ExpertCentral.com), or even Yellow Pages
- It is best to use a translator that "lives" in the local region; if a translator has not lived in a region for a decade he has missed 10 years of the local culture
- Also after your web content is translated, it is advisable to have it reviewed by a local "focus group" (where demographics can be considered also)

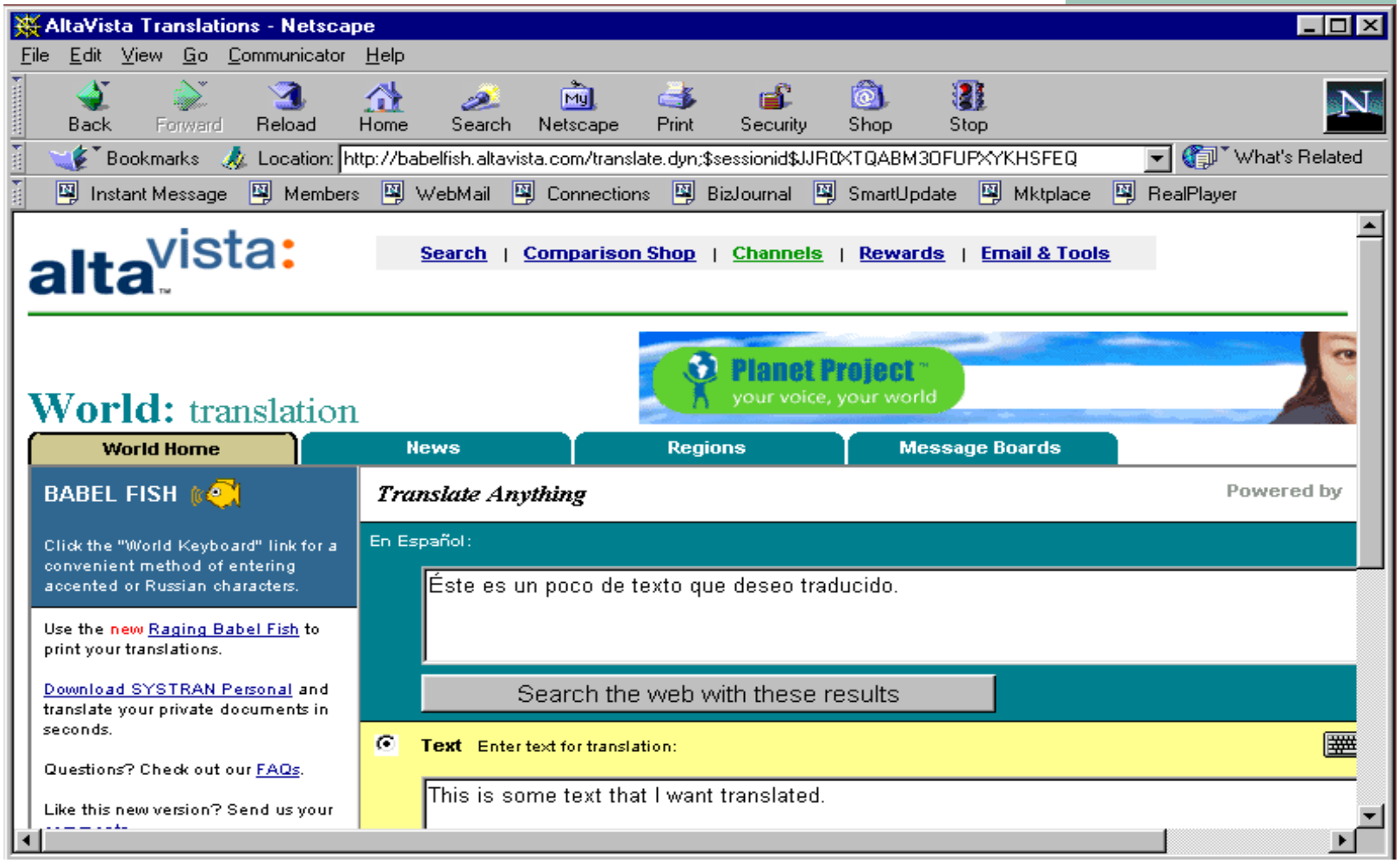
Software and Services

- There are also many companies that provide translation services such as: Aradco, VSI, eTranslate, Idiom, iLanguage, WorldPoint, and others
  - The cost of these services is about 25 cents per word per language
- Automatic translation software is still immature; some popular software products for translation are: www.e-ling.com, www.lhsl.com, and www.systransoft.com
- In addition there are several web sites which provide **free** translation services such as: google, http://babelfish.altavista.com and www.freetranslation.com

Using BabelFish



Using BabelFish (con't)



Sample Page to be Translated

School of Business Home Page ! - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss

Address C:\Articles\Global\SOB_Home_Page_English.html Go Links

Christian Brothers University

School of Business

"Where educating leaders is a tradition !"

U.S.News 2000 BEST COLLEGE

Ranked 23rd of 2000, by USNEWS Magazine!

Faculty | Under Graduate | MBA Program | Executive MBA | Catalog

My Computer

After Automatic Conversion

School of Business Home Page ! - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss

Address C:\Articles\Global\SOB_Home_Page_Spanish.html Go Links

Universidad Cristiana De los Hermanos

Escuela del negocio

"Donde está una tradición educar a arranques de cinta !"

U.S.News 2000 BEST COLLEGE

23ro alineada de 2000, por el compartimiento de USNEWS!

Facultad	Bajo Graduado	Programa Del MBA	Ejecutivo MBA	Catálogo

Done My Computer

After Modification by “Native”

School of Business Home Page ! - Microsoft Internet Explorer

File Edit View Favorites Tools Help

Back Forward Stop Refresh Home Search Favorites History Mail Print Edit Discuss

Address C:\Articles\Global\SOB_Home_Page_Spanish_Translator.html Go Links

La Universidad De los Hermanos Cristianos

La Escuela De Ciencias Administrativas

"Donde nuestra tradición es educar lideres !"

U.S.News 2000 BEST COLLEGE

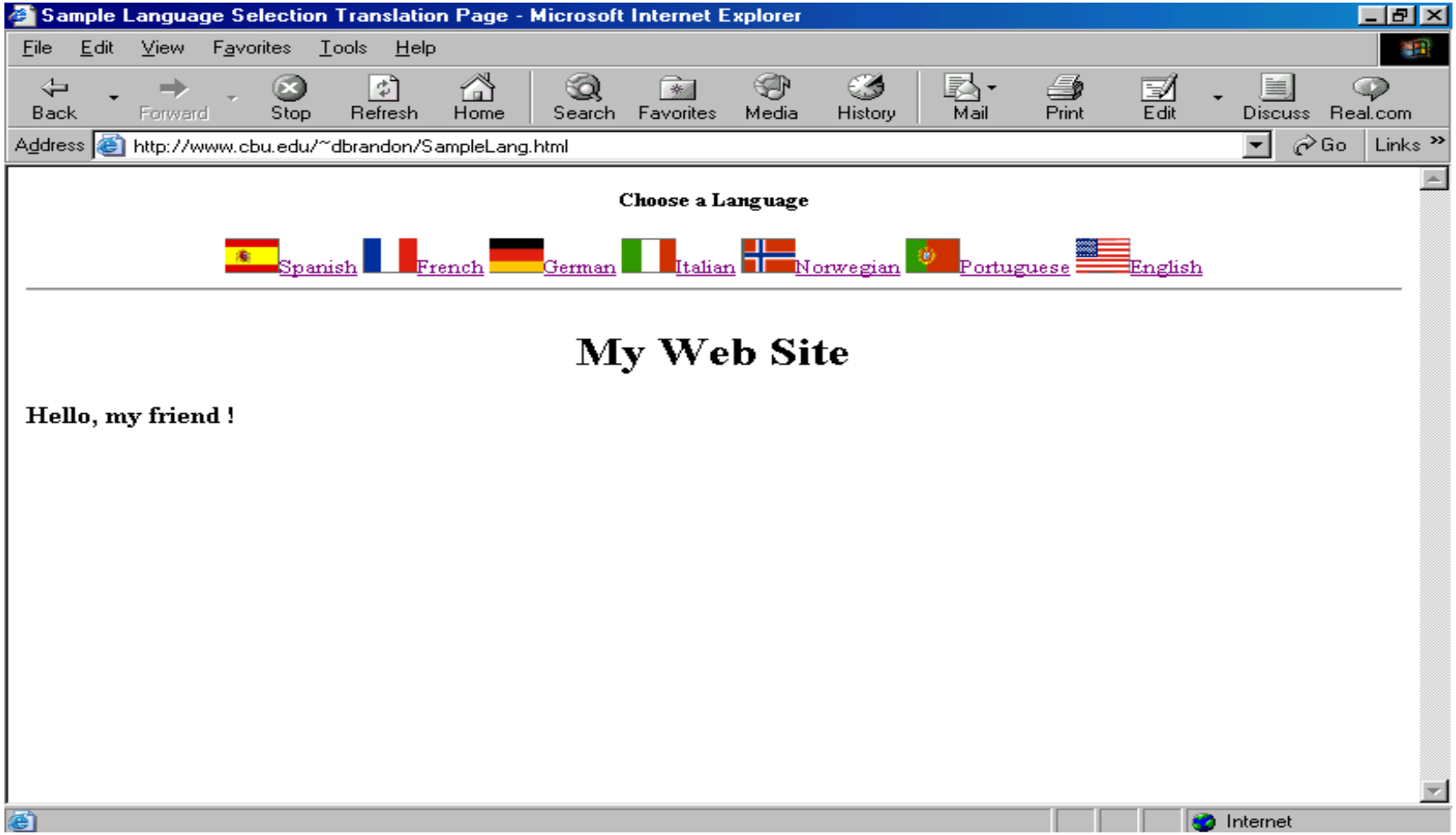
Lugar 23 en la lista de 2000 de acuerdo a USNEWS!

Facultad | Bachillerato | Programa Del MBA | MBA Ejecutivo | Catálogo

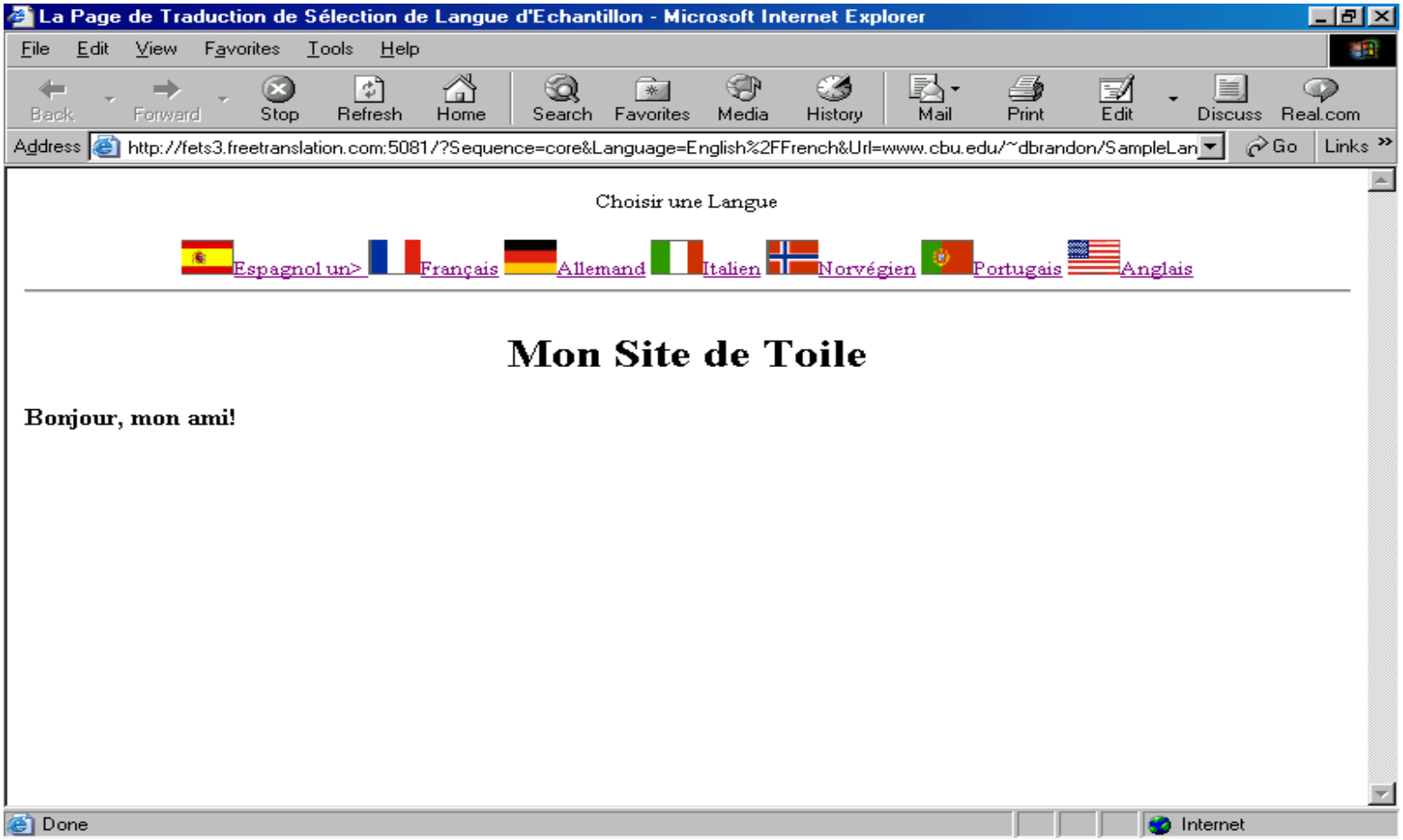
Done My Computer

Direct Linking to Online Translators

[http://www.cbu.edu/~dbrandon/SampleLang.html]

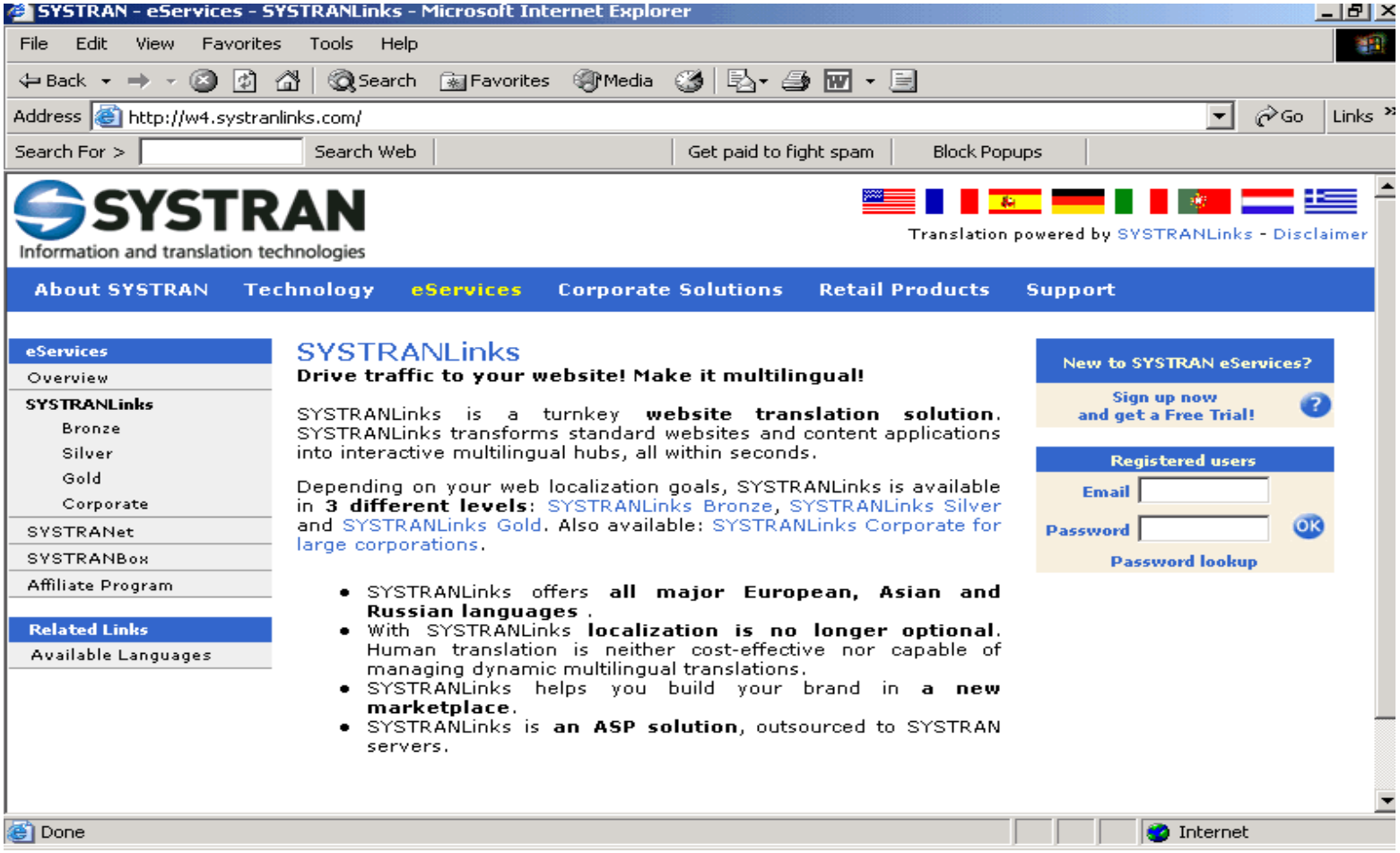


Translated Page

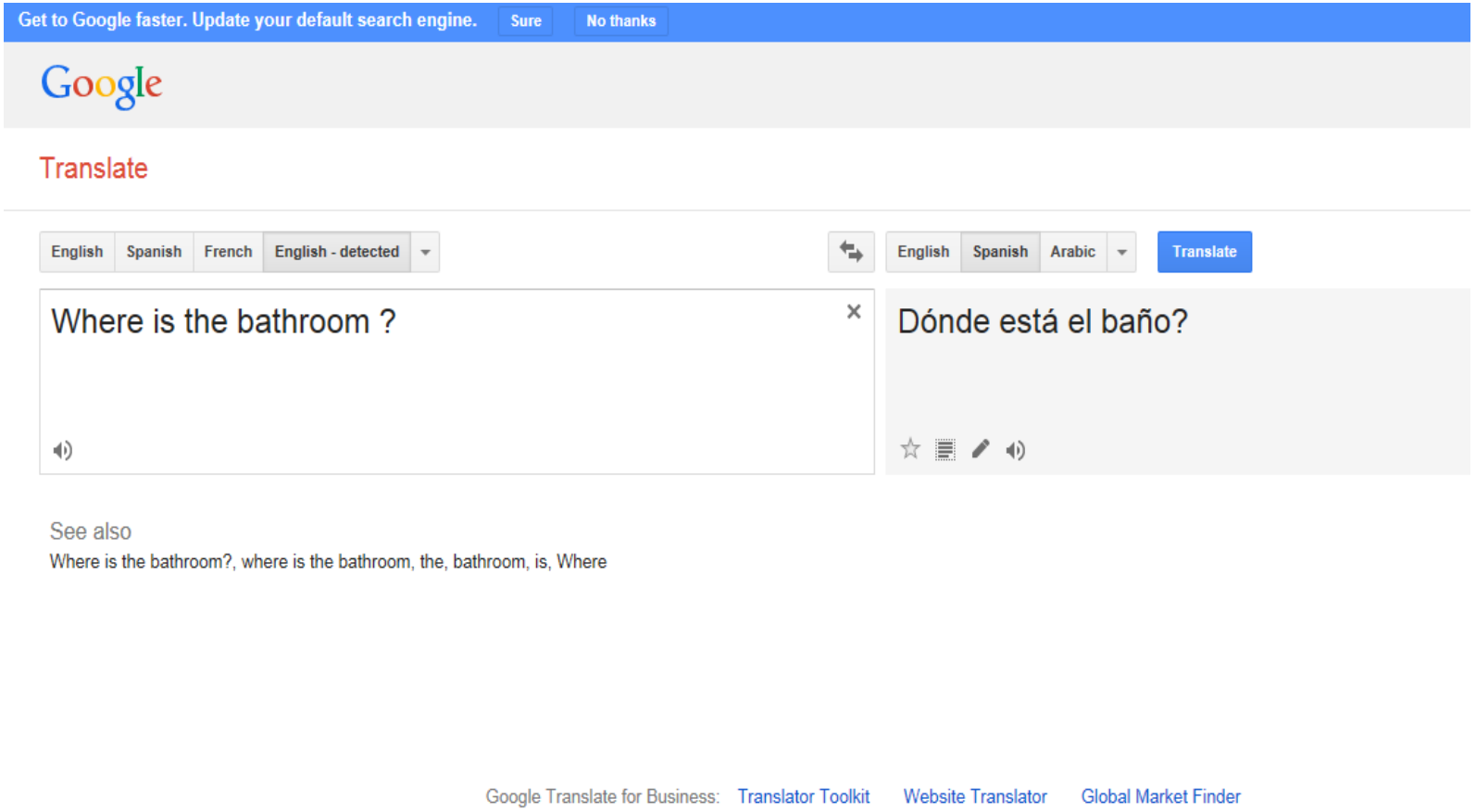


Comprehensive Web Translation Services

[http://w4.systranlinks.com/]



Google Translate



Maranello Caffé

Inspire Your Inner Italian

Select Language

Powered by Google Translate

Home | About | Products | Contact Us

I had some dreams, they were clouds in my coffee. ~Carly Simon

In Seattle you haven't had enough coffee until you can thread a sewing machine while it's running. ~Jeff Bezos

Google Translated to: Spanish Show original

Spanish
Powered by Google Translate

Maranello Caffé

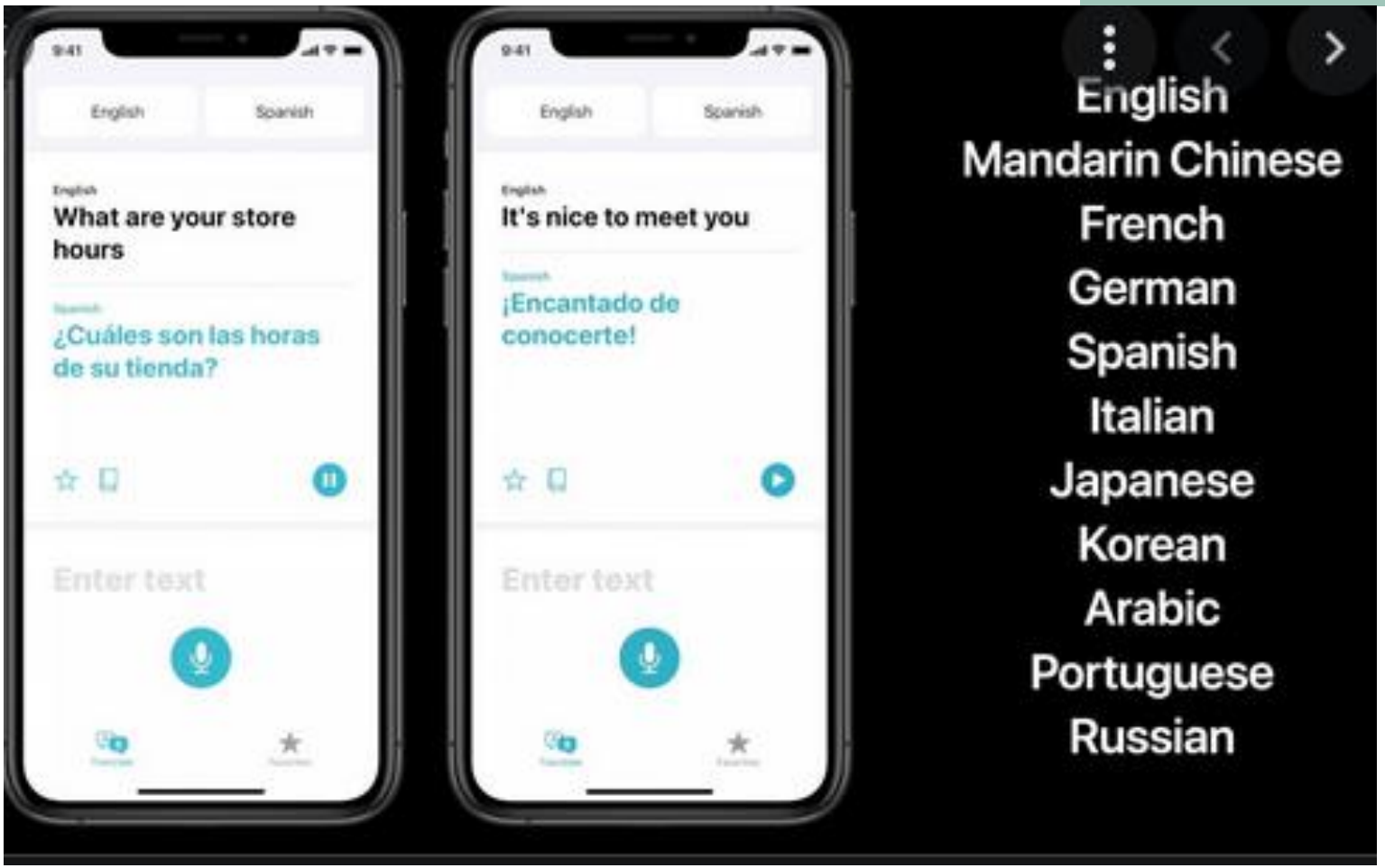
Inspire Your Inner Italian

Casa | Acerca de | productos | Contáctenos

Tenía algunos sueños, eran nubes en mi café. ~ Carly Simon

En Seattle no ha tenido suficiente café hasta que pueda enhebrar una máquina de coser mientras se está ejecutando. ~ Jeff Bezos

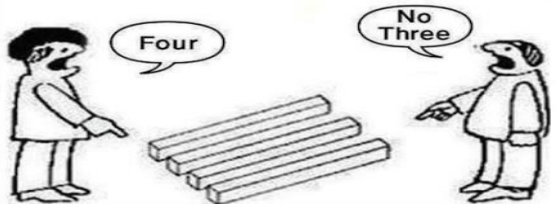
Google Translate on iPhone



Cultural Issues

- Creating an effective foreign web site involves much more than just a good language translation
- Not only do languages differ in other countries but semantics (the meaning of words and phrases) and cultural persuasions in a number of key areas are different
- To North Americans “football” is the NFL or *Tennessee vs Florida State*, but to the rest of the world it means soccer

Misunderstandings



- Cultural misunderstandings can be very serious
- A young Japanese man was shot and killed in Louisiana on a Halloween night because the homeowner of the door he was knocking on yelled “freeze”; he only understood the word to mean “very cold”
- A man in Los Angeles was killed because his shoe was pointing at a singer, and that was considered very insulting

Inoffensive

- "Sensitivity to culture and national distinction will separate success from failure"
- To be effective a web site has to not only be understandable and efficient, but has to be **culturally pleasing and inoffensive**
- To accomplish that, it may be necessary that not only is language localized, but that content, layout, navigation, color, graphics, text/symbol size, and style may be different

Cultural Blunders

- Many companies have put forth global web sites simply by translation the English into the targeted language, but then had to pull back and re-plan and redesign the localized site due to cultural offenses
- Some first try international web sites manage to generate multiple cultural offensives on their first try; one company had an offensive gender role, an offensive color, and an American "look" to the actors (even though they were of the correct ethnicity)
- General Motors tried to market the Chevy Nova in Mexico (in Spanish "No Va" means "doesn't go") !
- A pharmaceutical company wanted to market a weight loss pill in Europe called "Tegro", but in France that means "you are fat"
- Another pharmaceutical company marketed an HIV medication which meant "foolish love" in German

Technical Issues

- **While language and cultural issues are challenging parts of localizing a web site for a foreign audience**
- **A harder part is often all the technical challenges:**
  - **including date/currency formats, legal issues, units of measure, bandwidth capabilities, tagging HTML properly, correct character sets to use, managing multilingual pages on the server, directing users to the language specific content, configuration control, etc.**

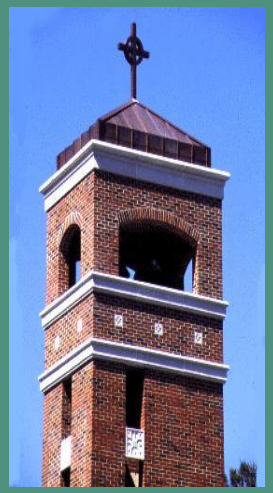
Some Standards Involved

- **Common ISO 639 - Language Codes**
- **Common ISO 3166 - Country Codes**

  Common ISO 4217 - Currency Codes
- **ISO 8601 - Date Format**
- **NAICS - North American Industry Classification System**
- **EAN – European Article Numbering**
- **UPC – Universal Product Code**
- **UPU – Universal Address Formats**
- **Greenwich 2000 – Time Standard**
- **ISO 10646, Unicode (16 bit character/symbol standard)**
- **World Wide Web Consortium (W3C) HTML 4.01 Specification**

Summary

- Globalization has become a vital factor in value and supply chain
  - Business web sites have to be “localized”
  - GIS is an information system that works across national borders
    - Organization's structure determines the architecture of its GIS
    - Some of the obstacles in using a GIS include lack of standardization and cultural/social/legal differences



Introduction to MIS

Mobile Communications

Learning Objectives

- Discuss the various types of wireless devices and wireless transmission media
- Describe Bluetooth, Wi-Fi, and WiMax
- Discuss the major M-commerce applications
- Discuss wireless security
- Understand the advantages and disadvantages of telecommuting for both employers and employees

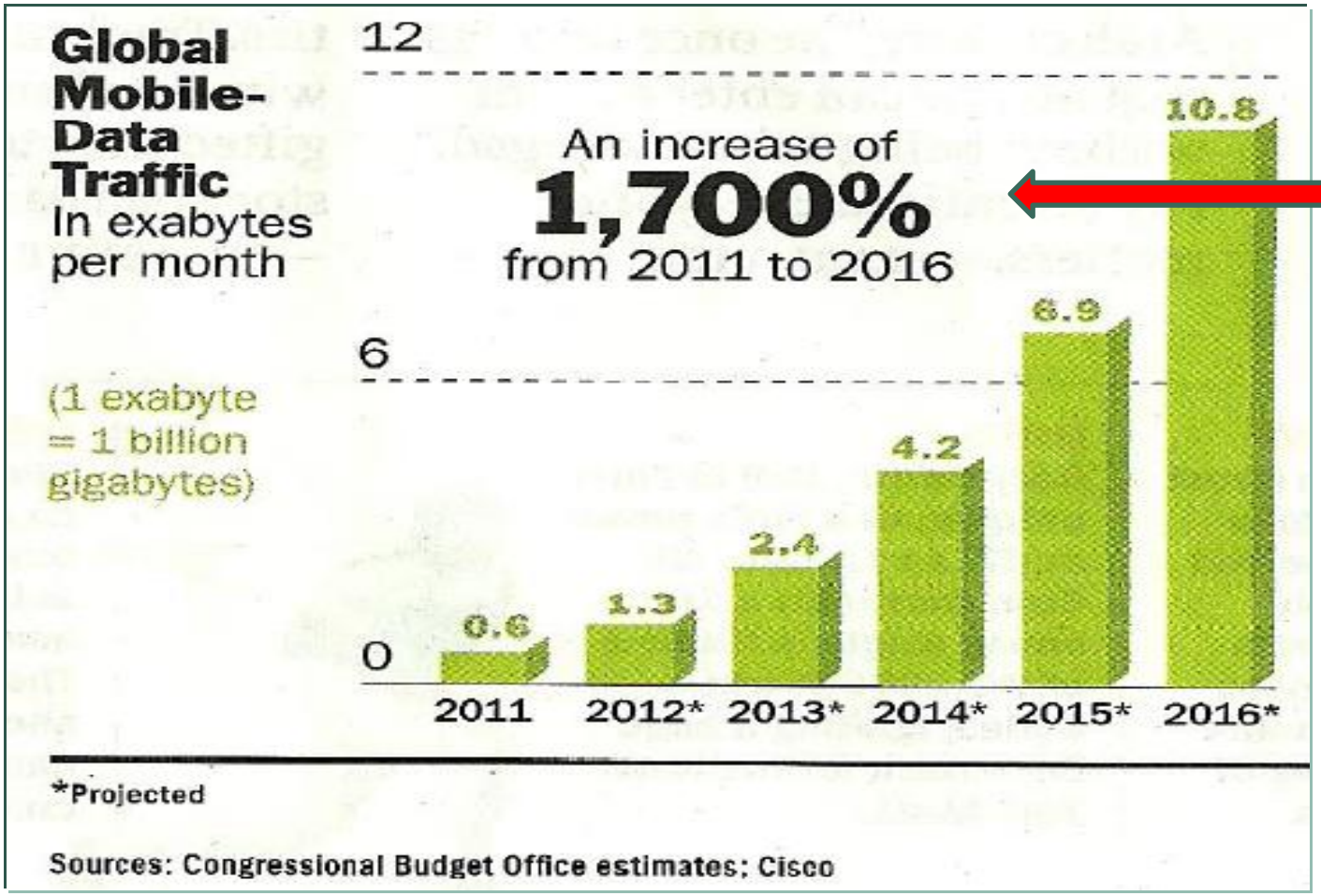
Consumerization

- **Consumerization** is the growing tendency for new information technology to emerge first in the consumer market and then spread into business and government organizations
- The emergence of consumer markets as the primary driver of information technology innovation is seen as a major IT industry shift, as large business and government organizations dominated the early decades of IT development
- The iPhone, tablets, and social media are recent examples as is wireless business applications

Wireless Technologies

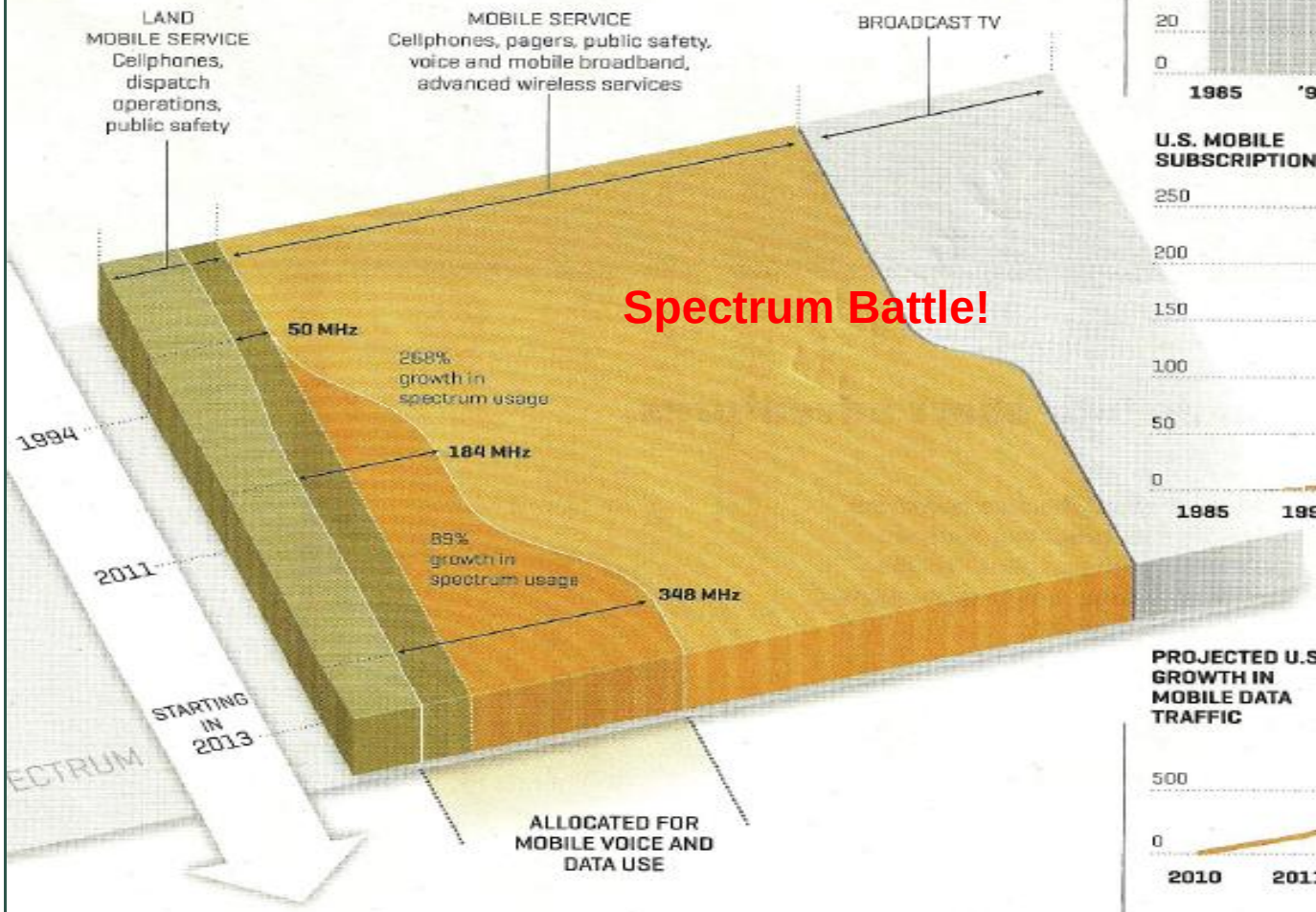
- **Wireless devices** are “portable” generally small enough to easily carry or wear, have sufficient computing power to perform productive tasks, and can communicate wirelessly with the Internet and other devices.
  - Includes laptops, netbooks, and tablets
  - Smart phones
  - PDAs and other wireless devices
  - Wireless devices attached to mobile vehicles

Mobile Data Traffic



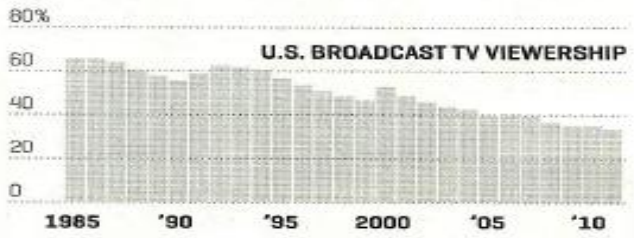
POLITICAL STALEMATE

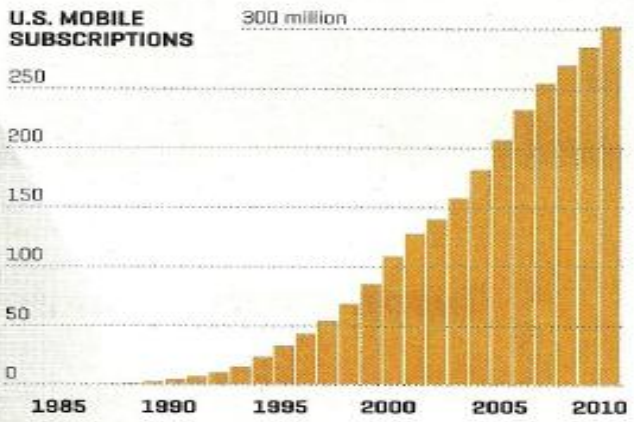
The 2010 National Broadband Plan called for 500 additional megahertz (MHz) of spectrum to be reallocated for broadband use. Where that new space will come from was left up to the FCC and legacy licensees—but no one can agree. The FCC—with support from AT&T, Verizon, and Sprint—is pushing TV broadcasters to auction off an additional 120 MHz, but the National Association of Broadcasters says that's unfair to poor viewers with no other access to TV. The impasse means the auctions are stalled.

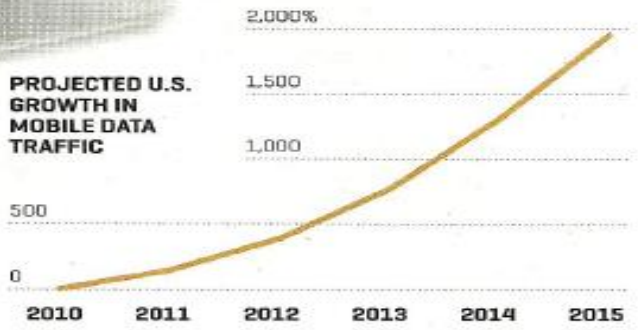


FEWER TV VIEWERS

The trend is indisputable: Broadcast television viewership is declining, and it has been for the past two decades.







SPECTRUM REALLOCATION—IS IT ENOUGH?

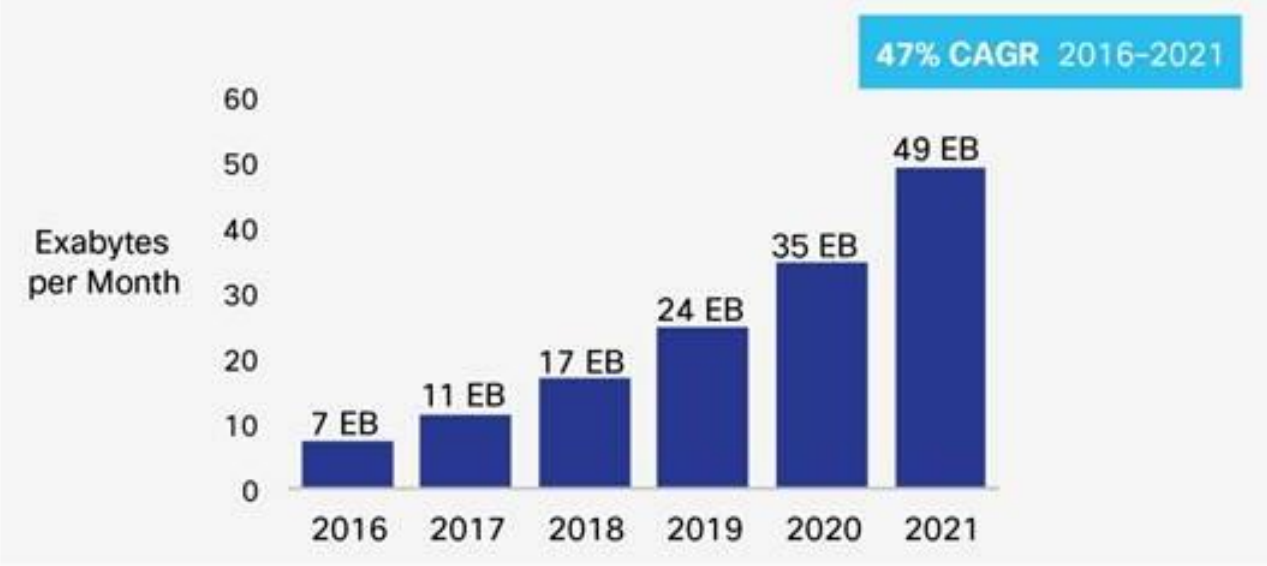
Since the 1990s the FCC has held 91 spectrum auctions, raising more than $50 billion; most recently, Verizon and other telcos were able to buy new spectrum in 2008. But the telecom providers claim that if they don't get more, service will suffer.

MOBILE DATA EXPLOSION

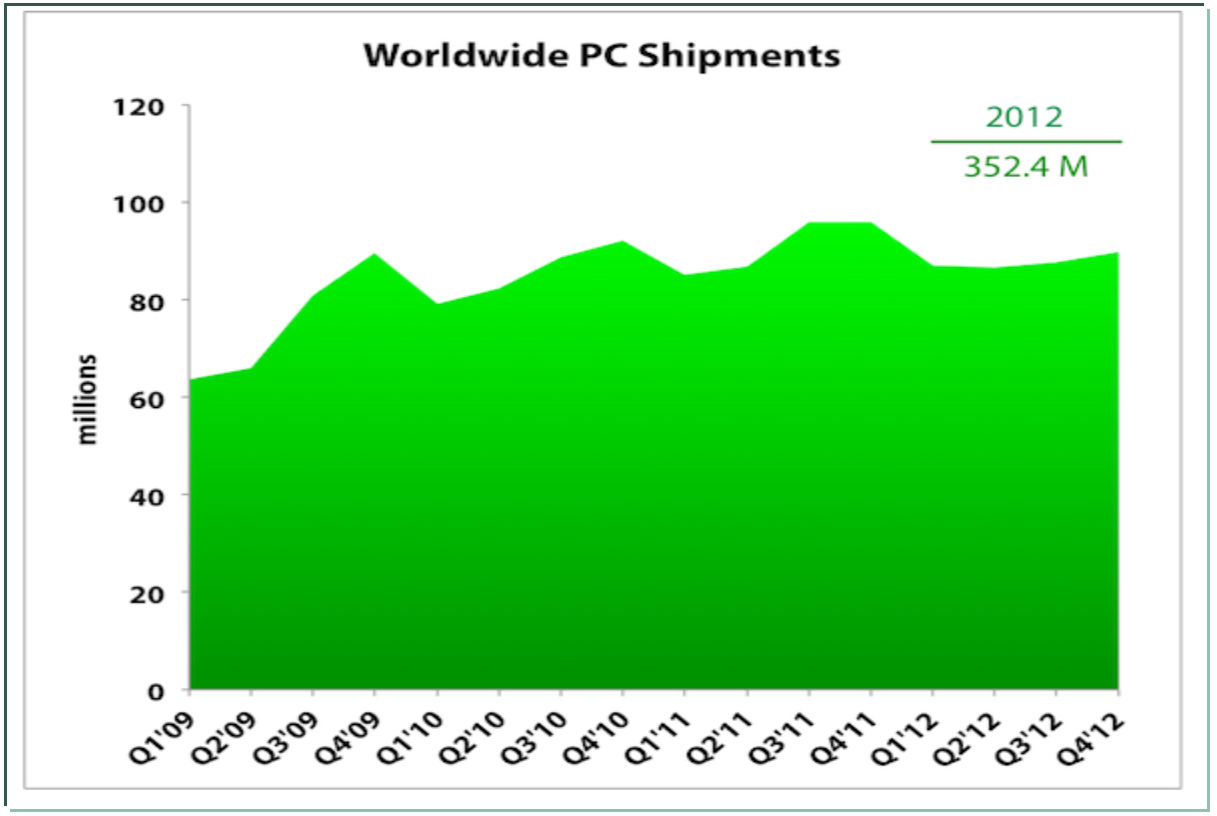
Since the birth of the iPhone and the Android operating system, mobile data use has exploded. By 2015 traffic will be some 20 times its 2010 level.

Mobile Growth Projections

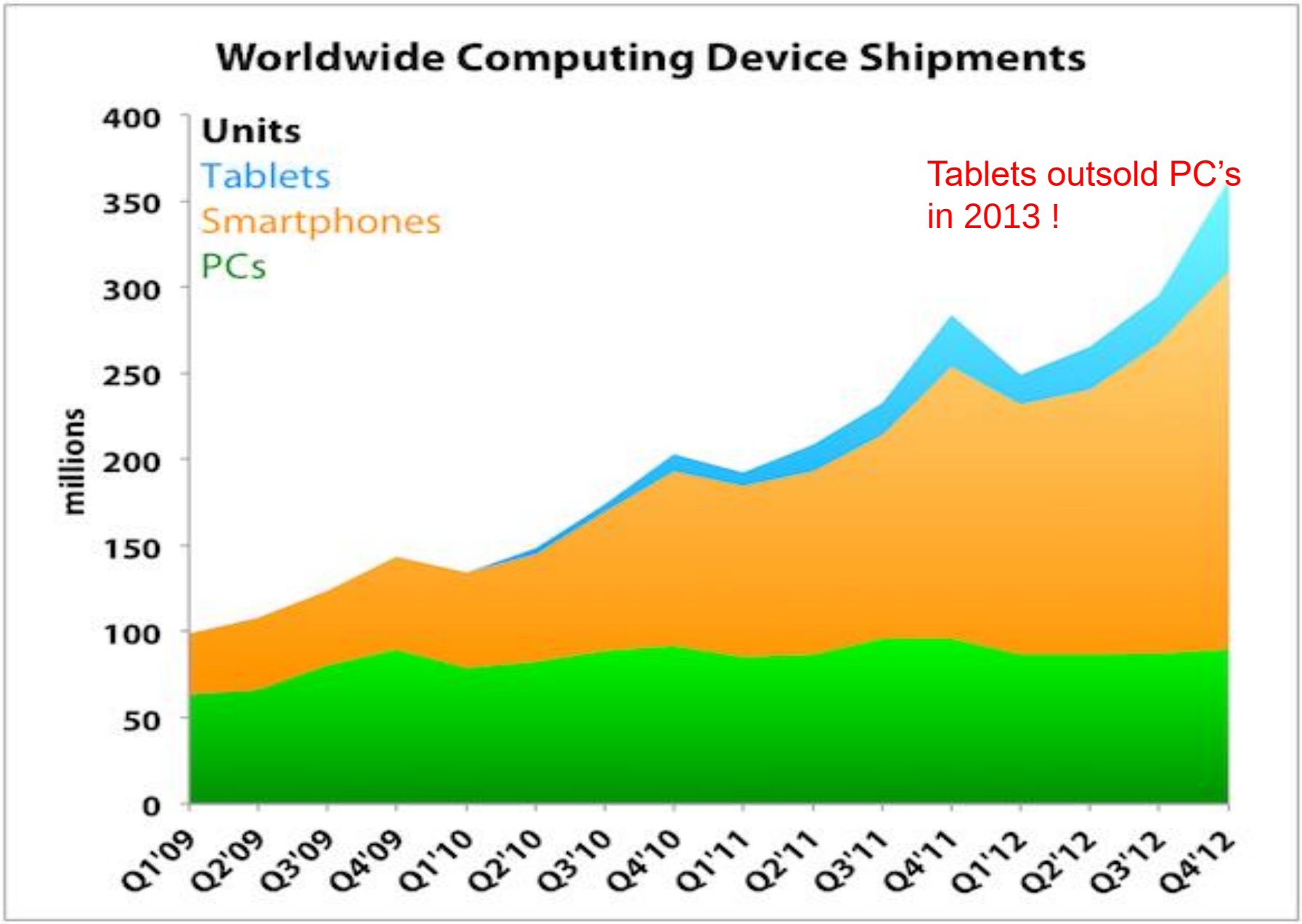
- The Global market for Wi-Fi/Wi-Max is already massive and the growth in connectivity just means even more mobile connections and traffic
- Global mobile data traffic is projected to increase 580% by 2021

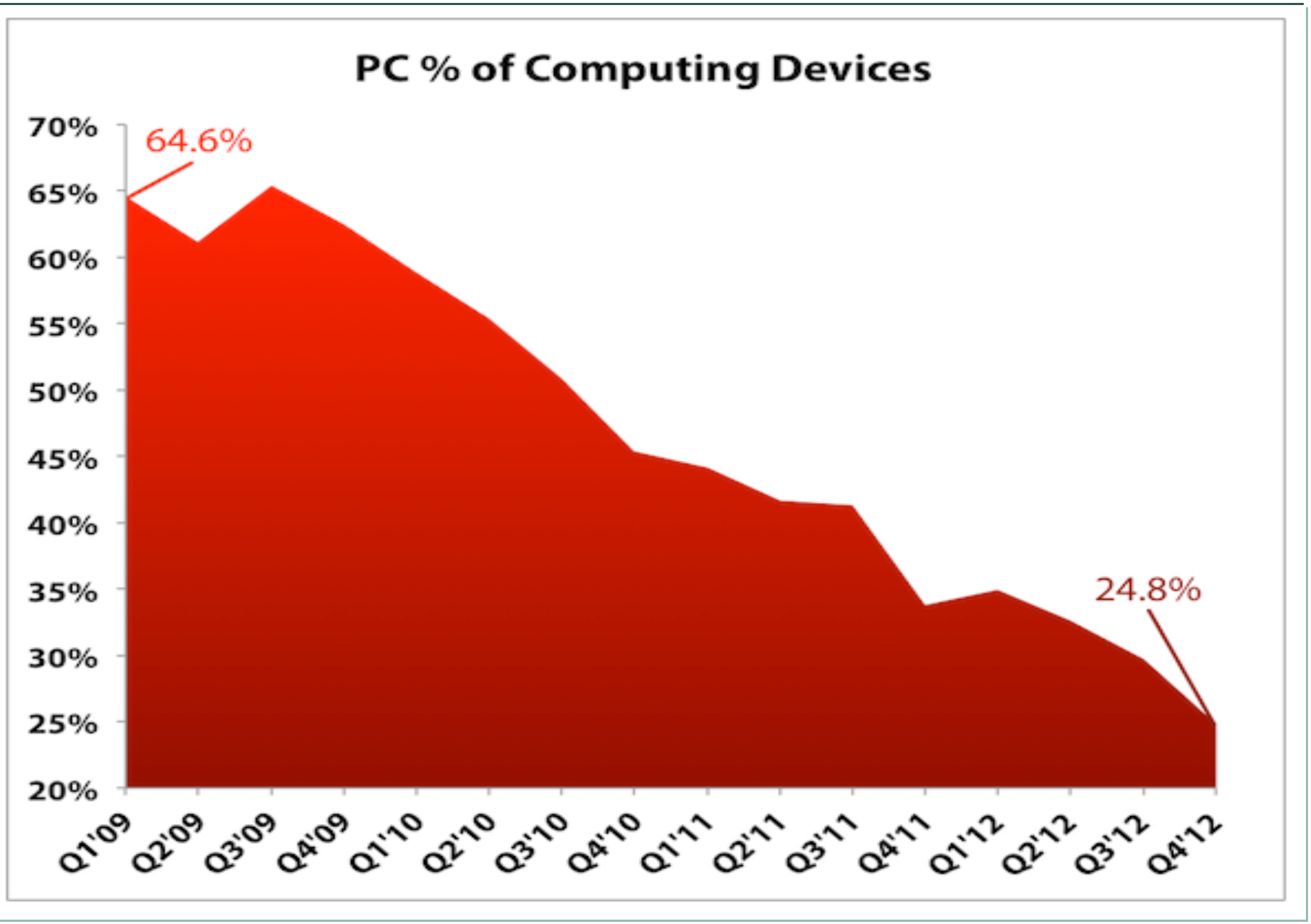


Is the PC dead ?



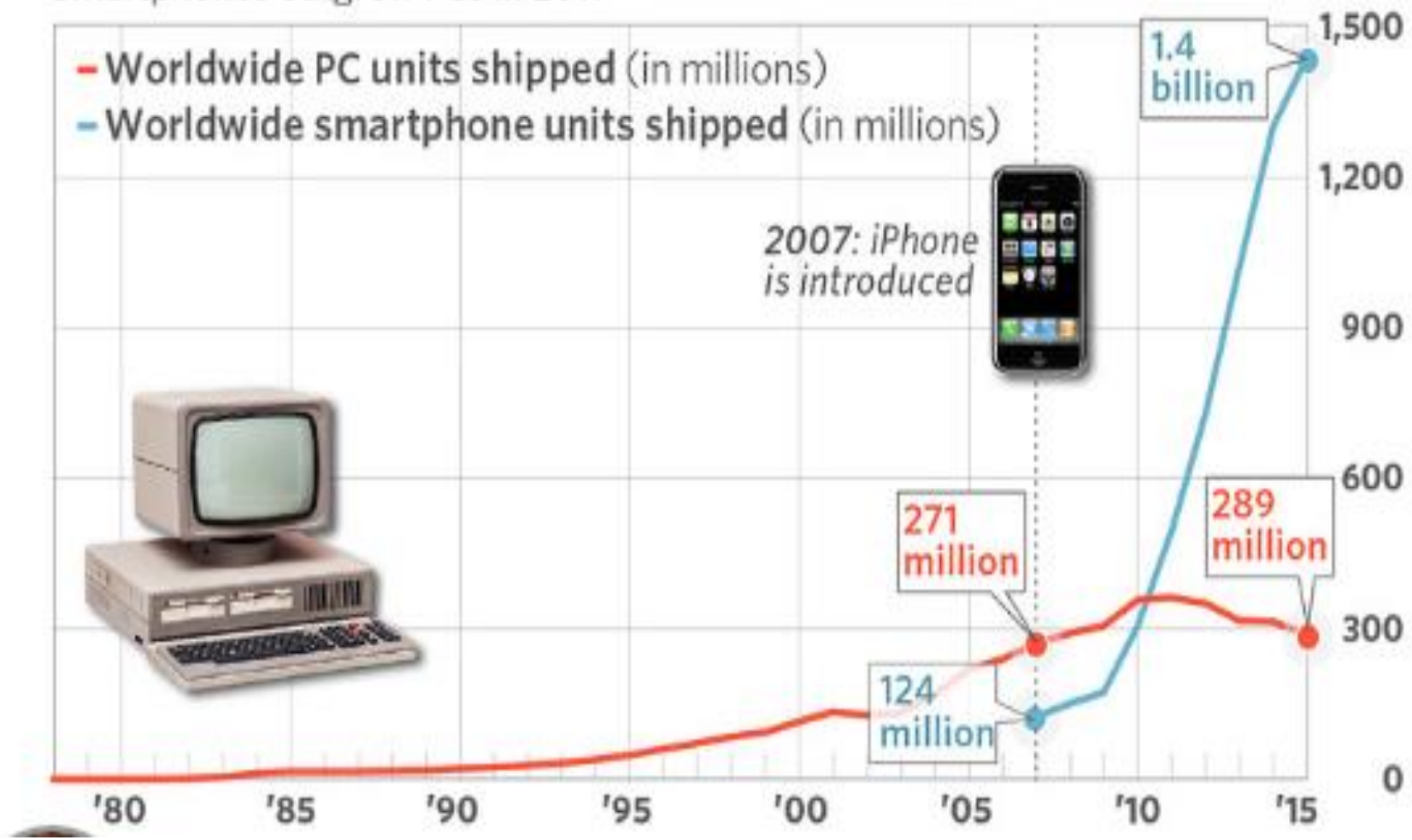
Don’t look ahead …





How smartphones killed the PC

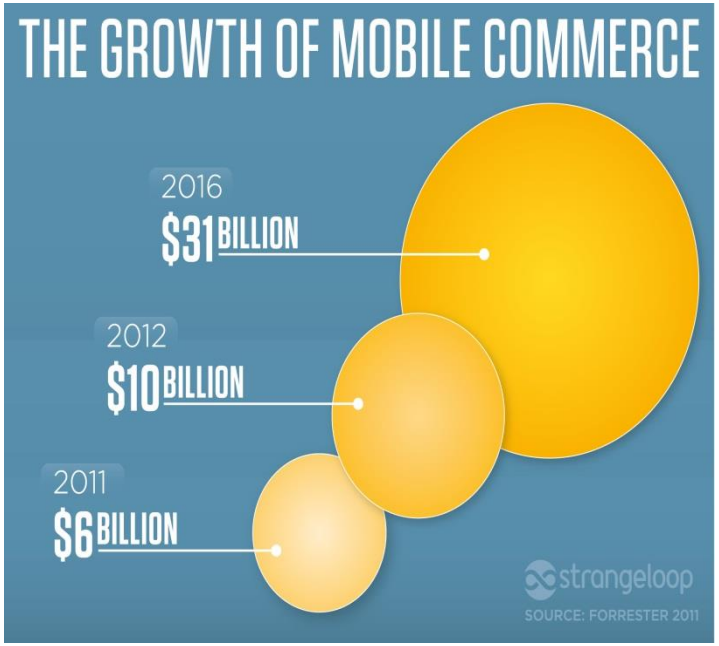
Smartphones outgrew PCs in 2011



iPhone, Win Phone, Droid

Mobile phones are now the most common device used for browsing the web.
Source: Gartner Reports

Why has business embraced mobile devices ?



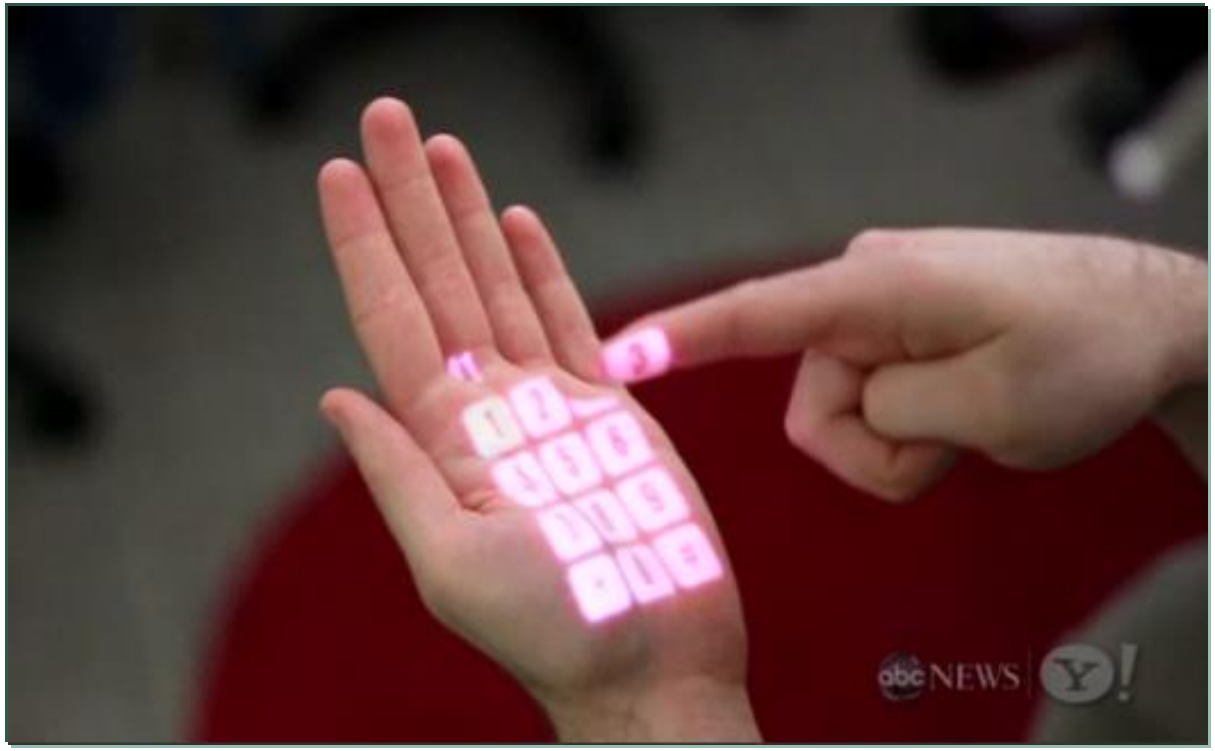
Don’t look ahead …

- Businesses want to reach the customer with advertising and product information
- Business want it to be easy and fast for customers to purchase goods
- Customers have mobile devices with them almost all of the time !

- **What matters still keep smart phones from taking over more work from desktop pc's and mac's ?**

Don’t look ahead …

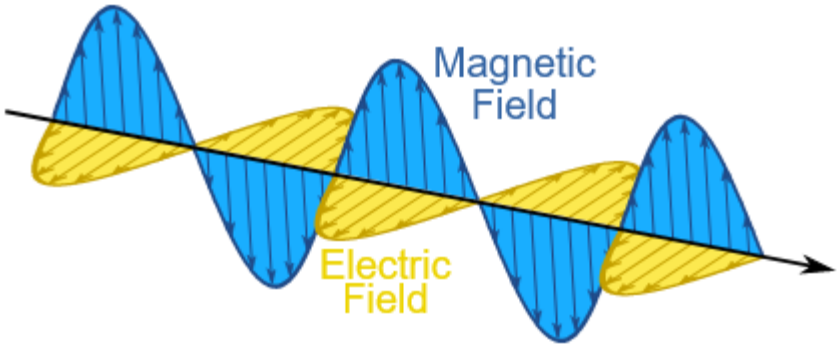
Future Virtual Keyboards & Monitors [OmniTouch]



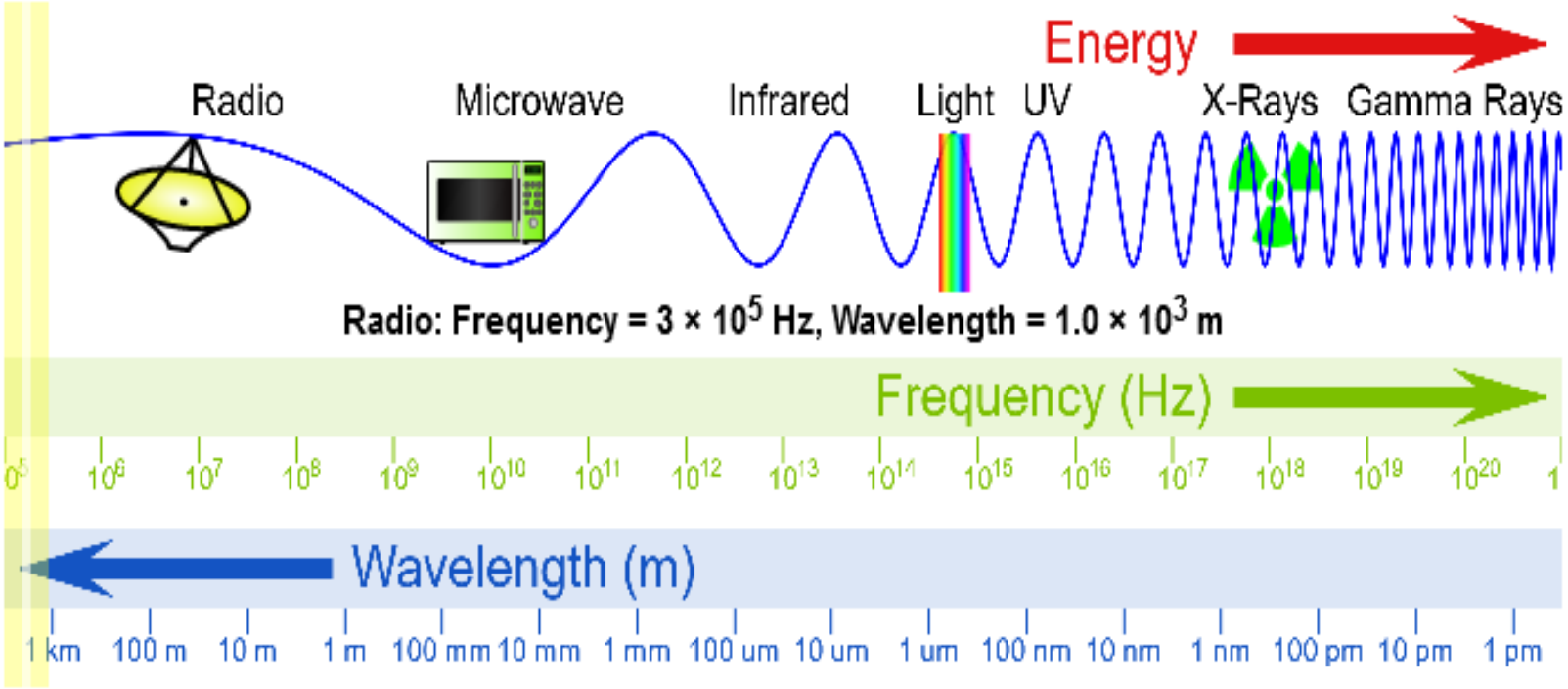
Overcoming small screen and keyboard size !

Electromagnetism

- It is called "electromagnetism" because electricity and magnetism are linked
- A changing electric field produces a magnetic field, a changing magnetic field produces an electric field
- This effect heads off through space at the fastest speed possible: the speed of light



Electromagnetic Spectrum



Visible light is in the middle of the spectrum.
Radio, Microwave, and Infrared are used for data communication.

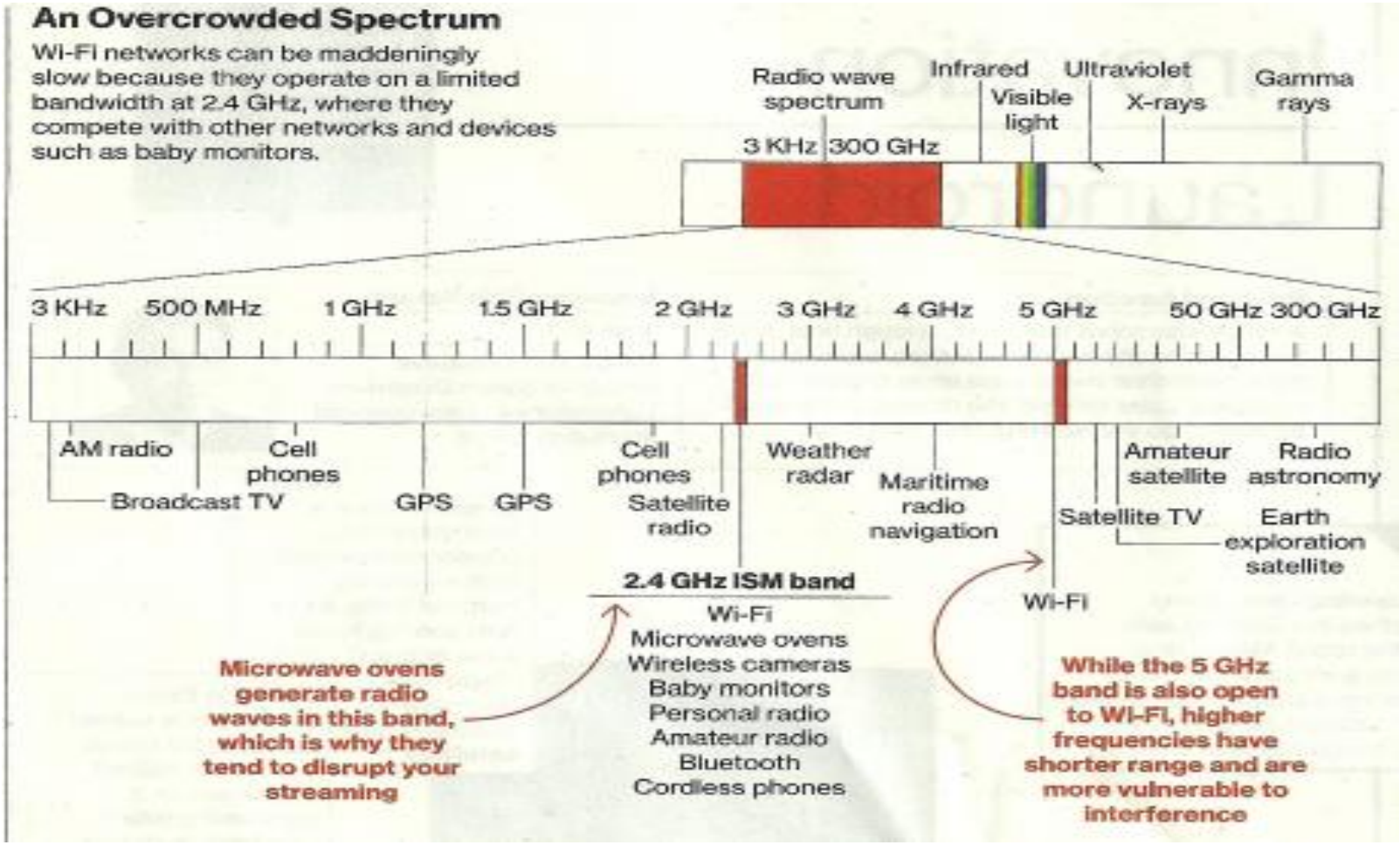
Electromagnetic Spectrum (con't)

- **Higher frequency** (rate of vibration) has **more energy** and shorter wavelength
- How waves interact with matter depends on their **energy** and the type of matter
  - Radio waves pass through our bodies
  - Some microwaves get absorbed and heat us up
  - Skin absorbs some infrared and light, and reflects the rest
  - UV (ultraviolet) is absorbed by the very outer layer of our skin (which causes sunburn and skin cancer)
  - X-rays are absorbed at different rates by bone and muscle so we can see inside us
  - Gamma rays mostly pass through, but any that get absorbed may harm our cells by ionization (see below)

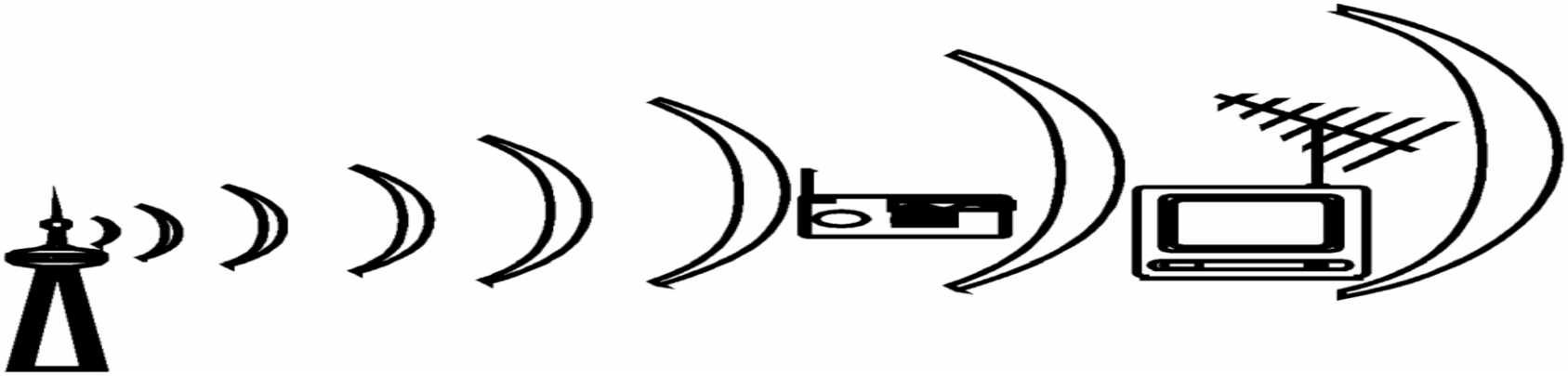
Wireless Transmission Media

- **Infrared** light is red light that is not commonly visible to human eyes
  - Low volume (short distance); common uses in remote control units for TVs, VCRs, DVDs, CD players - short distance
- **Microwave transmission systems** are widely used for high-volume, medium-distance, and point-to-point
  - *Point-to-point communication* has two characteristics:
    - first, the transmitter and receiver must be in view of each other (called *line-of-sight*)
    - and second, the transmission itself must be tightly directed from transmitter to receiver
- **Radio transmission** uses radio-wave frequencies to send data directly between transmitters and receivers (longer distances)

Radio Spectrum



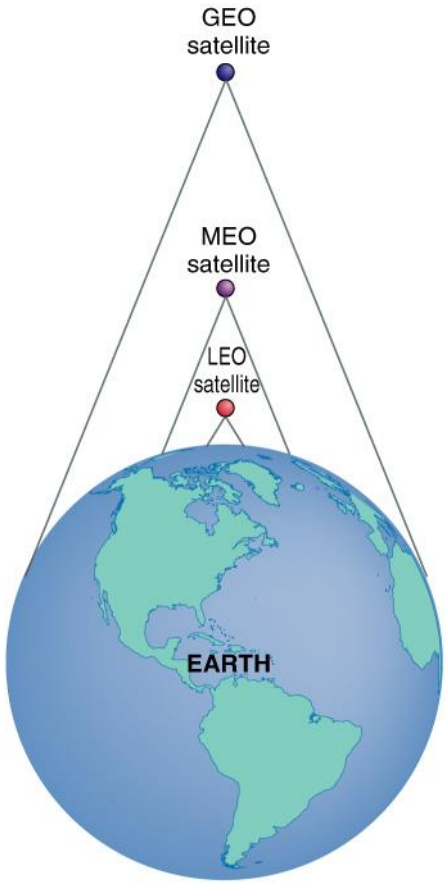
- **Radio waves travel very far, but what is the limitation is using radio waves for data communication ?**



Don’t look ahead …

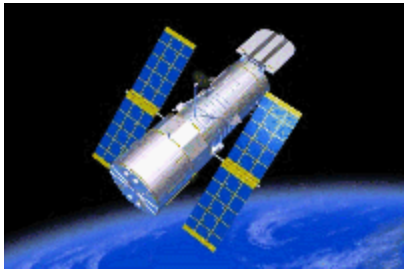
Satellite Transmission

- **Satellite transmission** systems make use of communication satellites
  - ***Geostationary earth orbit (GEO)*** orbits 22,300 miles directly above the equator and maintains a fixed position; excellent for TV (one way) signals
  - ***Medium earth orbit (MEO)*** are located 6,000 miles above the earth's surface and move; used for GPS and are less expensive
  - ***Low earth orbit (LEO)*** are 400 to 700 miles above the surface and move much quicker so many are needed to have adequate coverage; used mainly for telephone (two way)



Satellite Transmission (Con't)

- **Footprint** is the area of earth's surface reached by a satellite's transmission – overcomes the limitations of microwave data relay stations
- ***Broadcast* transmission** allows satellites to send signals to many receivers at one time



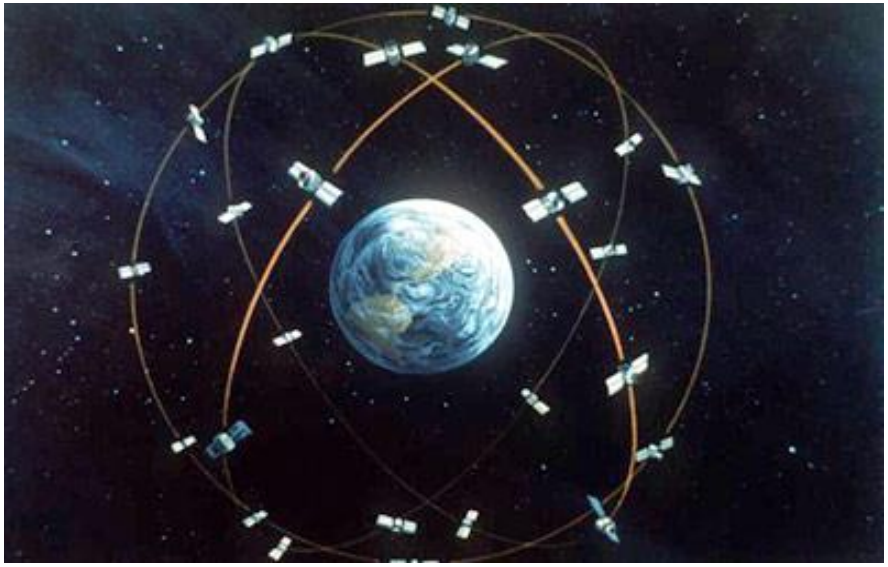
- **Propagation delay** is a brief pause in transmissions from satellites which make two-way telephone conversations difficult with higher satellites

Advantages and Disadvantages of Wireless Media

Channel	Advantages	Disadvantages
Microwave	High bandwidth. Relatively inexpensive	Must have unobstructed line of sight. Susceptible to environmental interference.
Satellite	High bandwidth. Large coverage area.	Expensive. Must have unobstructed line of sight. Signals experience propagation delay. Must use encryption for security.
Radio	High bandwidth. Signals pass through walls. Inexpensive and easy to install.	Creates electrical interference problems. Susceptible to snooping unless encrypted.
Infrared	Low to medium bandwidth.	Must have unobstructed line of sight. Used only for short distances.

Global Positioning Systems

- GPS is a wireless system that uses satellites to enable users to determine their position anywhere on the earth
- Supported by 24 shared MEO satellites worldwide



GPS Receivers

- A typical GPS receiver calculates its position using the signals from four or more GPS satellites
- Four satellites are needed since the process needs an accurate local time, more accurate than any normal clock can provide, so the receiver solves for time as well as position
- The receiver uses four measurements to solve for 4 variables - *x*, *y*, *z*, and *t*
- These values are then turned into more user-friendly forms, such as latitude/longitude or location on a map, then displayed to the user

GPS Satellites

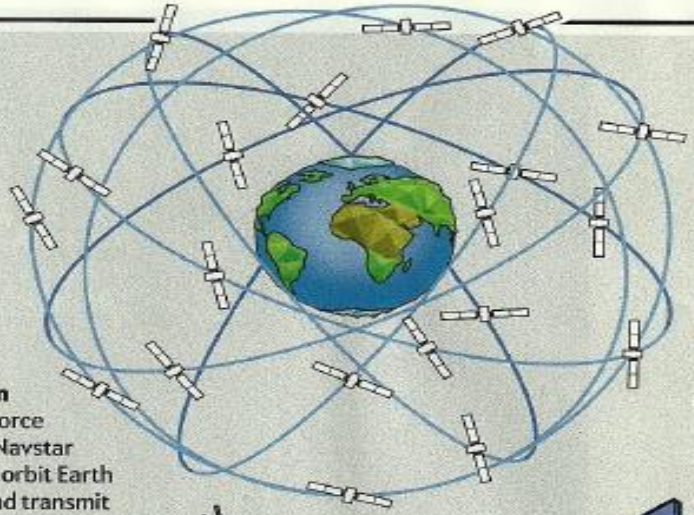
- Each GPS satellite has an atomic clock, and continually transmits messages containing the current time at the start of the message, parameters to calculate the location of the satellite and the general system health
- The signals travel at the speed of light through outer space, and slightly slower through the atmosphere
- The receiver uses the arrival time to compute the distance to each satellite, from which it determines the position of the receiver using geometry and trigonometry
- Although four satellites are required for normal operation, fewer may be needed in some special cases

GPS: Dependable but Vulnerable

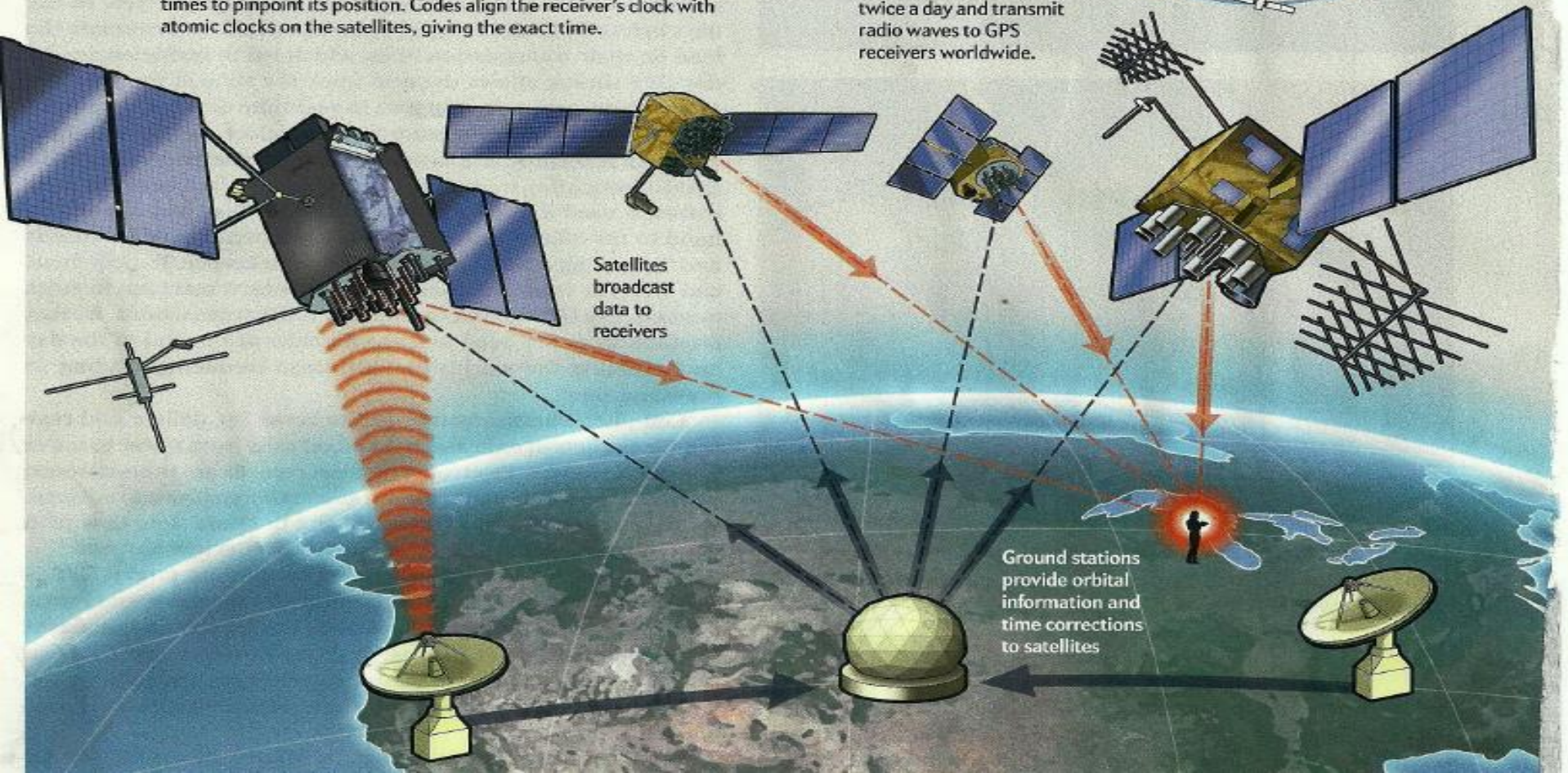
The electric grid, stock markets, banks, airliners and cell-phone networks all depend on satellite-based GPS for timing their intricate operations. It is not difficult for hackers to break in and throw off the timing, with potentially harmful consequences. Many countries have a ground-based network for backup during an attack, although the U.S. does not.

HOW GPS WORKS

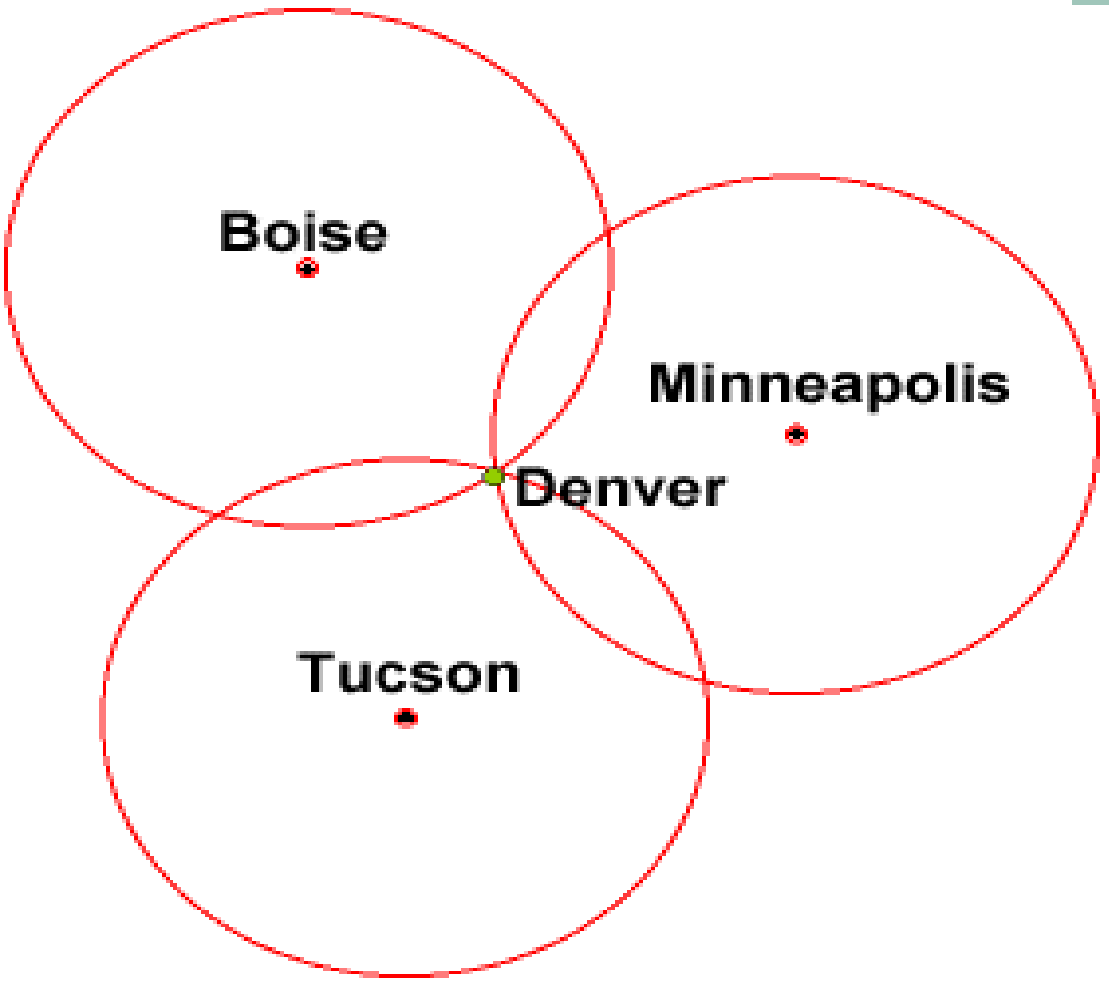
GPS satellites send synchronized signals that specify their position and time at any moment. A GPS device (*person in red circle*) receives signals from at least four satellites and compares the differences in their arrival times to pinpoint its position. Codes align the receiver's clock with atomic clocks on the satellites, giving the exact time.



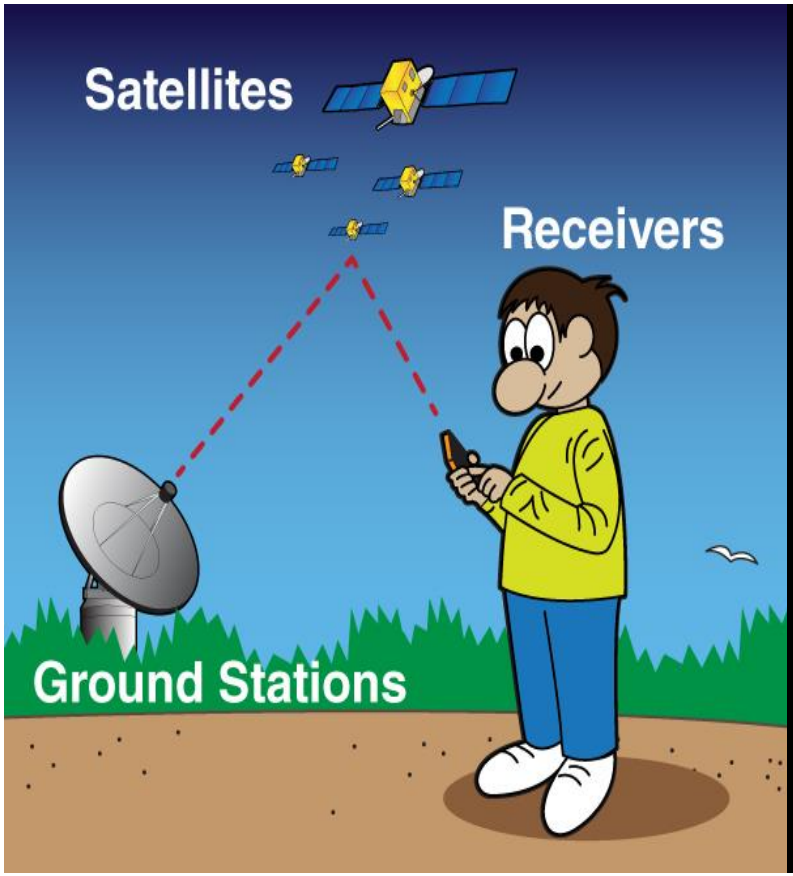
Satellite Constellation
The U.S. Air Force maintains 31 Navstar satellites that orbit Earth twice a day and transmit radio waves to GPS receivers worldwide.

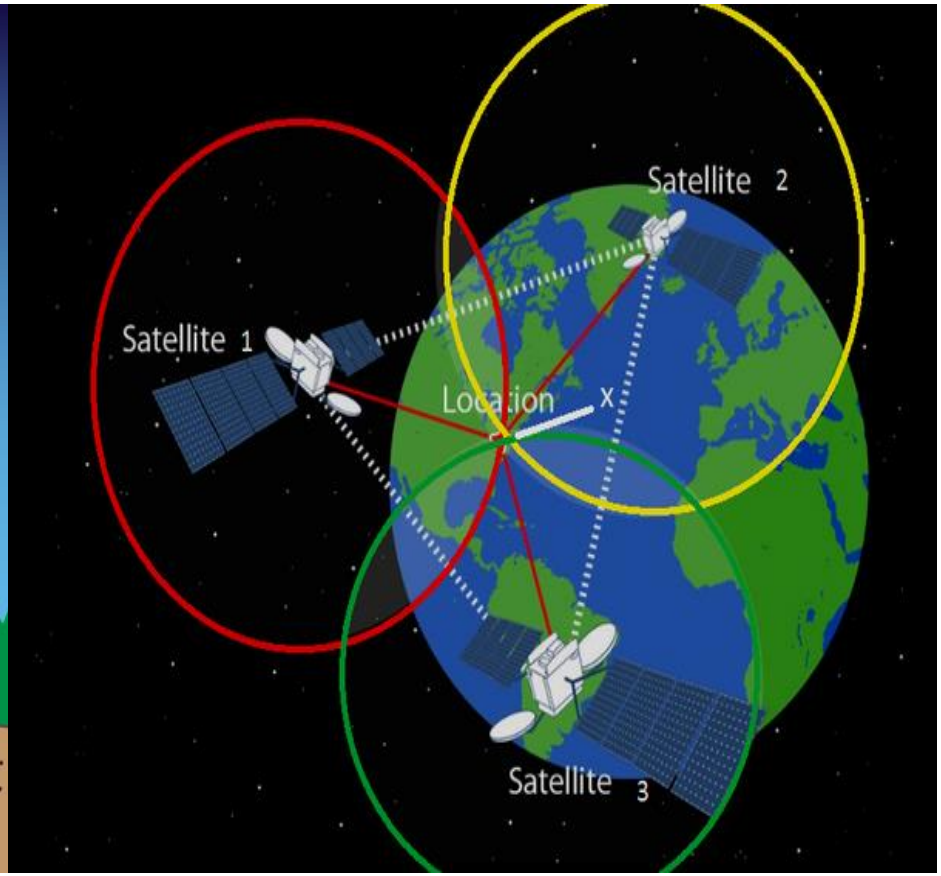


Trilateration

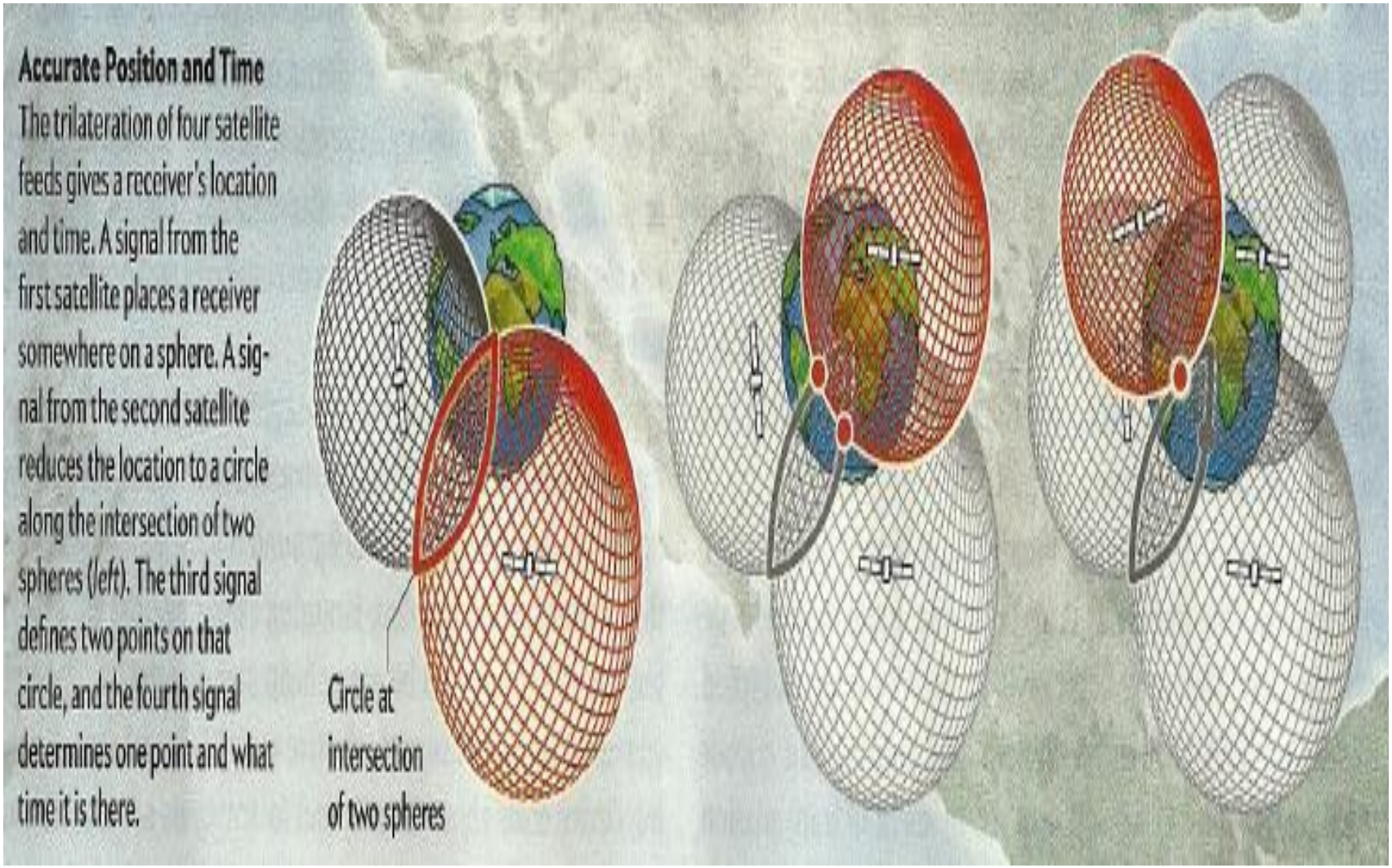


Trilateration (con’t)





Including time dimension…

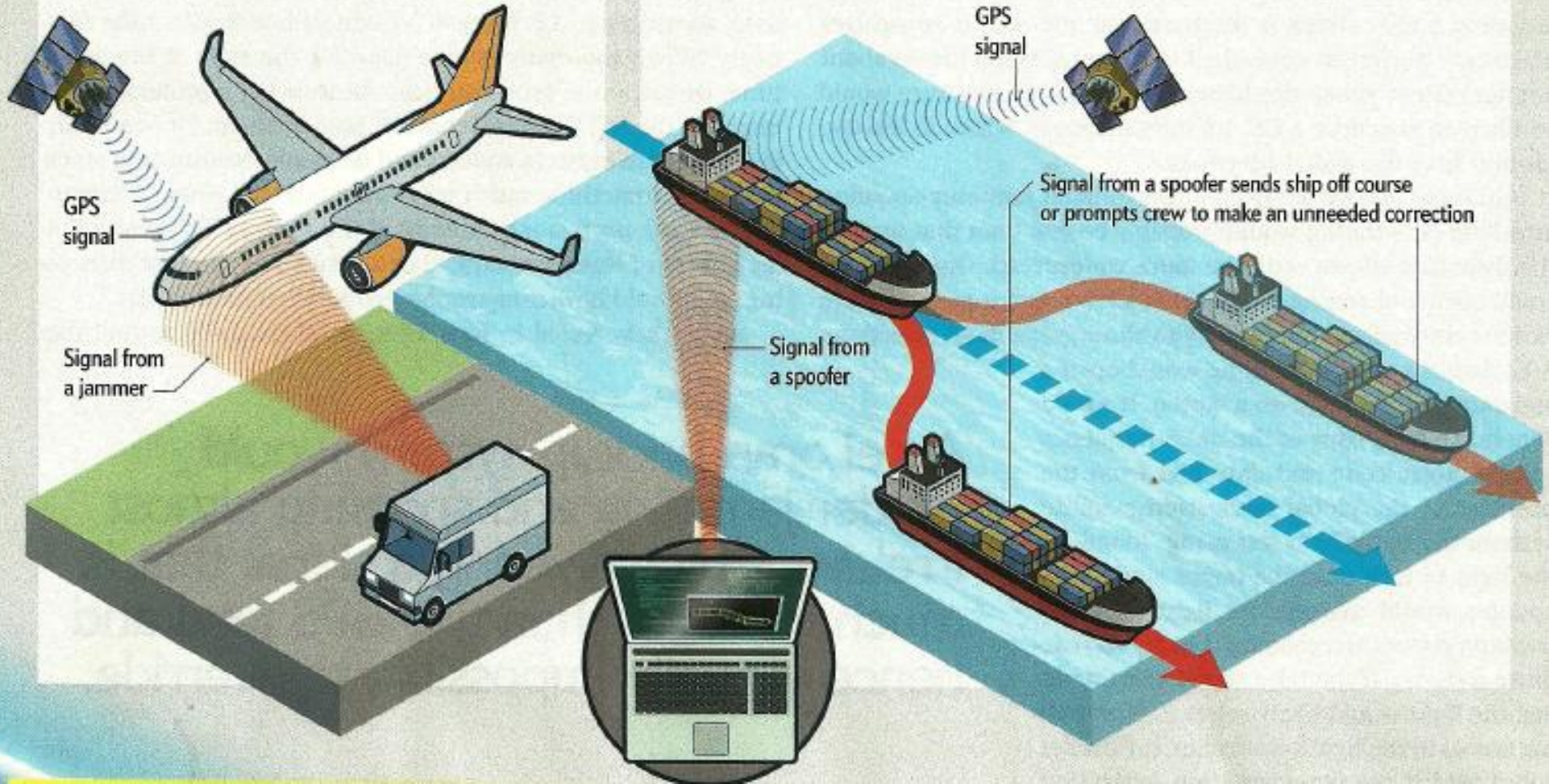


TWO WAYS TO HACK IN

Interfering with GPS timing can lead to electric-grid blackouts, stock market crashes and airliners that lose guidance during landing. Hackers can overpower (jam) or mimic (spoof) the radio waves GPS satellites transmit, giving receivers false information.

Jamming
GPS radio transmissions have very low power when they reach Earth. A hacker near a receiver can drown out the broadcast by blasting meaningless noise at the same frequency, making it hard for the receiver to stay connected to the signal or to lock onto it in the first place.

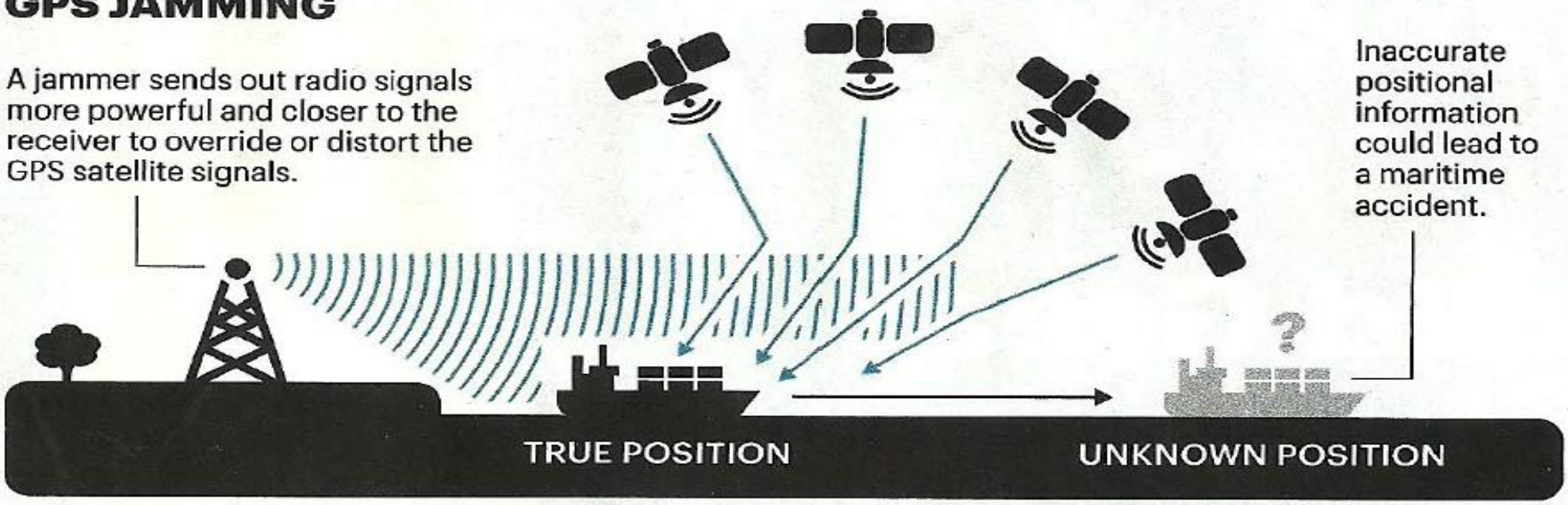
Spoofing
Each GPS satellite sends a unique code that identifies it. A hacker near a receiver can pick up the incoming codes, then retransmit them, slowly increasing their power until the receiver switches to the hacker as the originating source. The hacker can then send new radio signals that misdirect the receiver or fool human operators into thinking they are off course, which they might mistakenly try to correct.



GPS JAMMING

A jammer sends out radio signals more powerful and closer to the receiver to override or distort the GPS satellite signals.

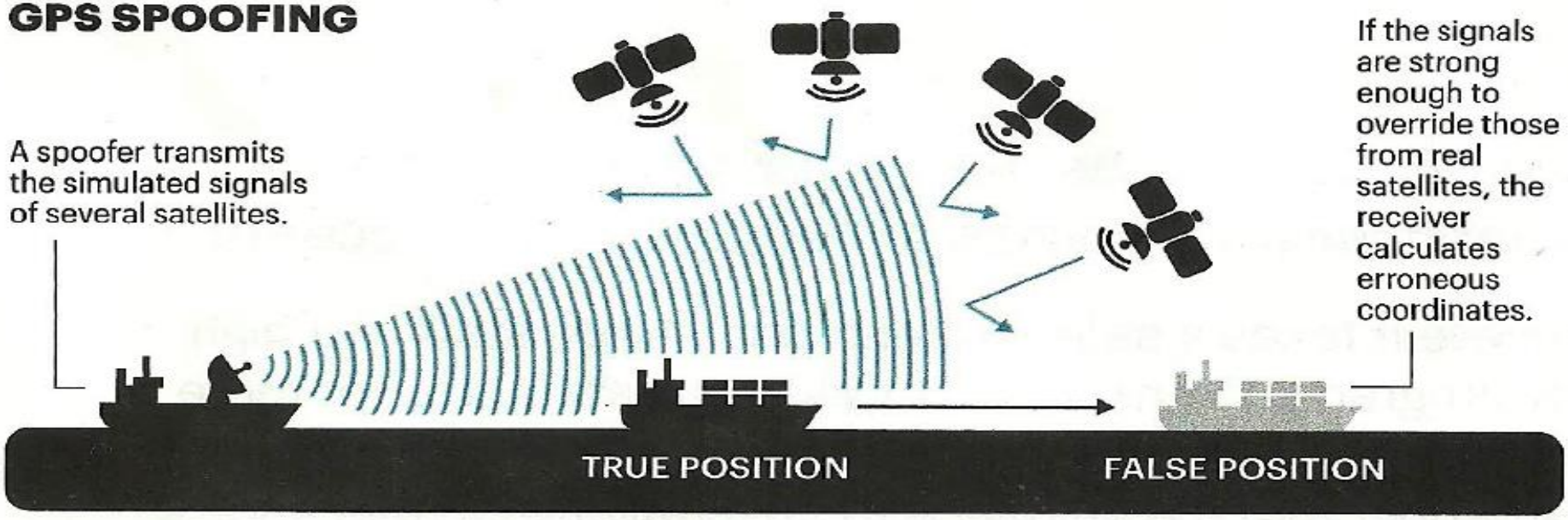
Inaccurate positional information could lead to a maritime accident.



GPS SPOOFING

A spoofer transmits the simulated signals of several satellites.

If the signals are strong enough to override those from real satellites, the receiver calculates erroneous coordinates.



BACKUP SYSTEM TO COUNTER ATTACKS

Many countries have a backup network that some receivers can switch to if satellite broadcasts are hacked or lost. Master stations and antennas on the ground emit strong, low-frequency radio waves that are very difficult to jam or spoof. A receiver picks up the signals from several pairs of transmitters to determine its location and time, though with less accuracy than with GPS. To be effective, a network should cover a country or region; one possible U.S. configuration is shown.

Differential Global Positioning System (DGPS)

- DGPS is an enhancement to GPS that provides improved location accuracy, from the 15-meter nominal GPS accuracy to about 10 cm
- DGPS uses a network of fixed, ground-based reference stations to broadcast the difference between the positions indicated by the GPS (satellite) systems and the known fixed positions
- These stations broadcast the difference between the measured satellite pseudoranges and actual (internally computed) pseudoranges, and receiver stations may correct their pseudoranges by the same amount
- The digital correction signal is typically broadcast locally over ground-based transmitters of shorter range
- The term refers to a general technique of augmentation
- The United States Coast Guard (USCG) runs such systems in the U.S. using longwave radio frequencies between 285 kHz and 325 kHz near major waterways and harbors

Land Based GPS

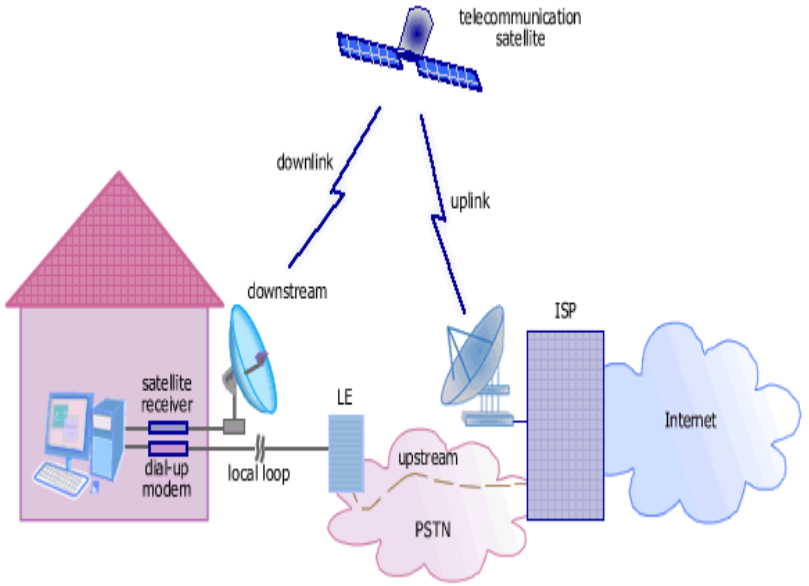
- GPS satellites are just fast moving clocks, spewing out time code as they hurtle through space
- Digital TV towers also spew time code, and could be a terrestrial GPS system or GPS assistant
- Companies have been working on this technology for a while, and it may be available soon
- The goal is to help devices that cannot received satellite signals (inside structures) enjoy the benefits of global positioning
- They work by locking onto the timecode embedded in TV signals from known locations

GPS Future

- Currently, GPS II satellites are up in orbit and GPS II provide locations that are accurate within about a meter
- Precision is dependent on changes in air density, interferences with Earth's ionosphere, and the location of the receiver (indoors or urban areas)
- GPS III have started being launched since December 2018 and will keep being launched until about 2025
- GPS III satellites consist of new sets of atomic clocks that will provide better accuracy in positioning
- GPS III reception will also be more reliable and more resistant to jamming and facilitate space navigation

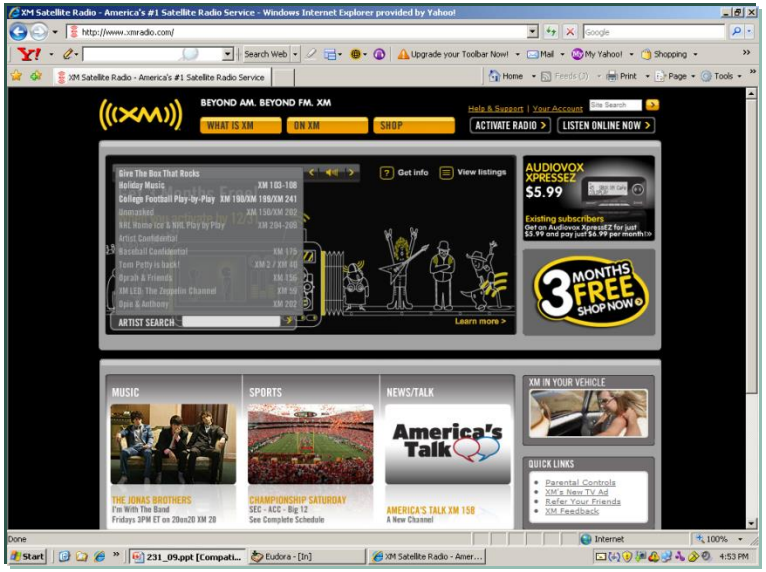
Internet over Satellite (IOS)

- IOS allows users to access the Internet via GEO satellites from a dish mounted on the side of their homes
  - Only option available in some areas
  - Can have a propagation delay or be disrupted by environmental conditions



Satellite Radio

- **Satellite radio** (**digital radio**) offers uninterrupted, near CD-quality music that is beamed to your radio from space
  - XM satellite radio uses GEO
  - Sirius uses MEO
  - Now merged



Wireless Computer Networks Standards

- IEEE standards (802 protocols) for wireless computer ethernet networks include:
  - IEEE 802.15 (Bluetooth) for wireless personal area networks (PANs) and 802.15.4 (Zigbee)
  - IEEE 802.11 (Wi-Fi) for wireless local area networks (WLANs)
  - IEEE 802.16 (Wi-Max) for wireless metropolitan area networks (WMANs)
  - IEEE 802.20 (Mobile-Fi - proposed) for wireless wide area networks (WWANs)

Bluetooth

- **Bluetooth** is used to create small PANs:
  - can link up to 8 devices within a 10-meter area, and newer versions extend distance
  - uses low-power, radio-based communications
  - can transmit up to 1 Mbps
- **Personal area network (PAN)** is a computer network used for communication among computer devices (e.g., telephones, PDAs, smart phones) close to one person
  - Security issues even in the PAN

Bluetooth (con't)

- Bluetooth communications is now available on many new cars, so that one can wirelessly connect their smartphone to the car's radio
- Now one can play their iTune music collection in the car
- With Apples new radio service, that can be linked to the car radio, so there is no really need to pay for XM/Sirius or Pandora in your car anymore

Zigbee

- **Zigbee** targets applications that need low data transmission rates and low power consumption:
  - Moves data only one-fourth as fast as Bluetooth
  - Can handle hundreds of devices at once
  - One promising application is meter reading
    - Why don't we have smart-meters in Memphis ?
- Current focus is to wirelessly link sensors that are embedded into industrial controls, medical devices, smoke and intruder alarms, and building and home automaton

Wireless Local Area Networks (Wi-Fi)

- **WLAN** (IEEE 802.11 or Wi-Fi) requires a transmitter with an antenna, called a **wireless access point**, that connects to a wired LAN (or to satellite dishes) that provide an Internet connection
  - **Wireless network interface card (NIC)** is needed to communicate wirelessly and has a built-in radio and antenna – USB or card (slot)
  - **Hotspot** is a wireless access point that provides service to a number of users within a small geographical perimeter (up to a couple hundred feet)

Wi-Fi - **Wireless Fidelity** (802.11) Protocols

[breaking thru 200 Mbit/s limit]

V·T·E **802.11 network PHY standards** [hide]

802.11 protocol	Release date[6]	Frequency (GHz)	Bandwidth (MHz)	Stream data rate[7] (Mbit/s)	Allowable MIMO streams	Modulation	Approximate range[citation needed] Indoor (m)	Indoor (ft)	Outdoor (m)	Outdoor (ft)
802.11-1997	Jun 1997	2.4	22	1, 2	N/A	DSSS, FHSS	20	66	100	330
a	Sep 1999	5	20	6, 9, 12, 18, 24, 36, 48, 54	N/A	OFDM	35	115	120	390
		3.7[A]					—	—	5,000	16,000[A]
b	Sep 1999	2.4	22	1, 2, 5.5, 11	N/A	DSSS	35	115	140	460
g	Jun 2003	2.4	20	6, 9, 12, 18, 24, 36, 48, 54	N/A	OFDM	38	125	140	460
n	Oct 2009	2.4/5	20	400 ns GI : 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65, 72.2 [B] 800 ns GI : 6.5, 13, 19.5, 26, 39, 52, 58.5, 65 [C]	4	MIMO-OFDM	70	230	250	820[8]
			40	400 ns GI : 15, 30, 45, 60, 90, 120, 135, 150 [B] 800 ns GI : 13.5, 27, 40.5, 54, 81, 108, 121.5, 135 [C]			70	230	250	820[8]
ac	Dec 2013	5	20	400 ns GI : 7.2, 14.4, 21.7, 28.9, 43.3, 57.8, 65, 72.2, 86.7, 96.3 [B] 800 ns GI : 6.5, 13, 19.5, 26, 39, 52, 58.5, 65, 78, 86.7 [C]	8		35	115[9]		
			40	400 ns GI : 15, 30, 45, 60, 90, 120, 135, 150, 180, 200 [B] 800 ns GI : 13.5, 27, 40.5, 54, 81, 108, 121.5, 135, 162, 180 [C]			35	115[9]		
			80	400 ns GI : 32.5, 65, 97.5, 130, 195, 260, 292.5, 325, 390, 433.3 [B] 800 ns GI : 29.2, 58.5, 87.8, 117, 175.5, 234, 263.2, 292.5, 351, 390 [C]			35	115[9]		
			160	400 ns GI : 65, 130, 195, 260, 390, 520, 585, 650, 780, 866.7 [B] 800 ns GI : 58.5, 117, 175.5, 234, 351, 468, 702, 780 [C]			35	115[9]		
ad	Dec 2012	60	2,160	Up to 6,912 (6.75 Gbit/s) [10]	N/A	OFDM, single carrier, low-power single carrier	60	200	100	300
ah	Est. 2016[6]	0.9								
aj	Est. 2016[6]	45/60								
ax	Est. 2019[6]	2.4/5				MIMO-OFDM				
ay	2017	60	8000	Up to 100,000 (100 Gbit/s)	4	OFDM, single carrier,	60	200	1000	3000

Problems with Wi-Fi

- **Roaming** – users cannot roam from hotspot to hotspot if the hotspots use different Wi-Fi network protocols or services (or different security settings)
- **Security** – because Wi-Fi uses radio waves, it is more difficult to protect – need encryption
- **Cost** – commercial Wi-Fi services are low cost but not free, and each service has its own fees and separate accounts for users to logon
  - **Now on commercial airlines for a fee of about $5**

Wireless Security

- Four major threats
  - *Rogue access point* is an unauthorized access point to a wireless network
  - *War driving* is the act of locating WLANs while driving around a city or elsewhere
  - *Eavesdropping* refers to efforts by unauthorized users to try to access data traveling over wireless networks
  - *RF (Radio frequency) jamming* is when a person or a device intentionally or unintentionally interferes with your wireless network transmissions

Wireless Security (con't)

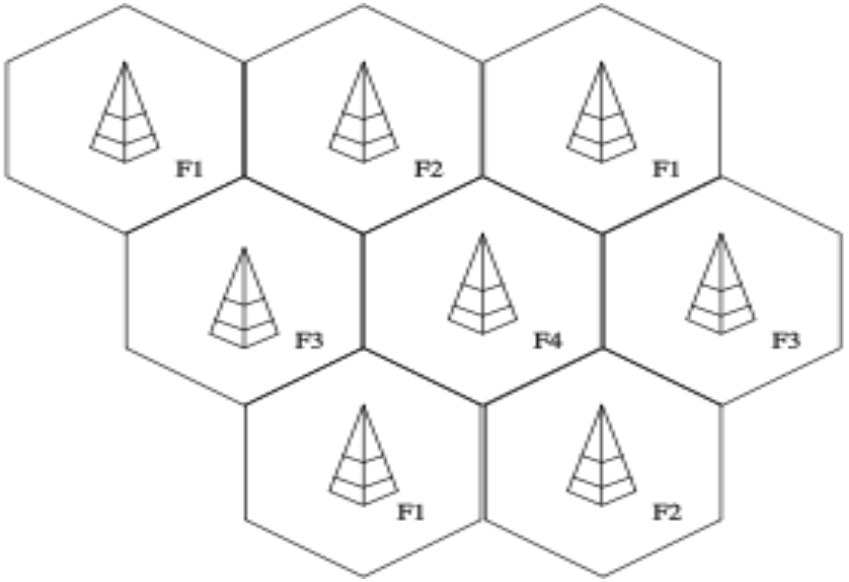
- By default (out of the box) wireless routers do not have security enabled
- Major business have suffered huge losses (i.e. TJ Max) when their wireless networks were tapped into
- Need to use latest WPA (not older WEP) security (see appendix)
- People have been arrested due to the Web activity (i.e. downloading illegal music or child porno) of their neighbors
- In some countries now it is against to law for anyone to have an insecure wireless network

Cellular Wireless Communication

- A **cellular network** is a radio network made up of a number of **radio cells** (or just **cells**) each served by a fixed transmitter, known as a cell site or base station
- These cells are used to cover different areas in order to provide radio coverage over a wider area than the area of one cell - cellular networks are inherently asymmetric with a set of fixed main transceivers each serving a cell and a set of distributed (generally, but not always, mobile) transceivers which provide services to the network's users
- Cellular networks offer a number of advantages over alternative solutions:
  - increased capacity
  - reduced power usage
  - better coverage
- A good (and simple) example of a cellular system is an old taxi driver's radio system where the taxi company will have several transmitters based around a city each operated by an individual operator

Frequency Reuse & Handover

The increased capacity in a cellular network, compared with a network with a single transmitter, comes from the fact that the same radio frequency can be reused in a different area for a completely different transmission.



As the phone user moves from one cell area to another, the switch automatically commands the handset and a cell site with a stronger signal (reported by the handset) to go to a new radio channel (frequency). When the handset responds through the new cell site, the exchange switches the connection to the new cell site.

3G

- **3G** is the **third generation** of mobile phone standards and technology, superseding 2.5G and based on the International Telecommunication Union (ITU) family of standards under the IMT-2000
- 3G networks enable network operators to offer users a wider range of more advanced services while achieving greater network capacity through improved spectral efficiency
- Services include wide-area wireless voice telephony, video calls, and broadband wireless data, all in a mobile environment; additional features also include HSPA data transmission capabilities able to deliver speeds up to 14.4Mbit/s on the downlink and 5.8Mbit/s on the uplink (802.11n wi-fi is up to 150Mbits/sec)
- Unlike IEEE 802.11 (common names Wi-Fi or WLAN) networks, 3G networks are *wide area cellular telephone networks* which evolved to incorporate high-speed internet access and video telephony

WiMax & Beyond

- **Worldwide Interoperability for Microwave Access**, popularly known as **WiMax**, is the name for IEEE standard 802.16.
  - Wireless access range of up to 30 miles
  - Speeds comparable to Wi-fi - Data transfer rate of 1 Gbps (1000 Mbps)
  - Secure system that offers both voice and video

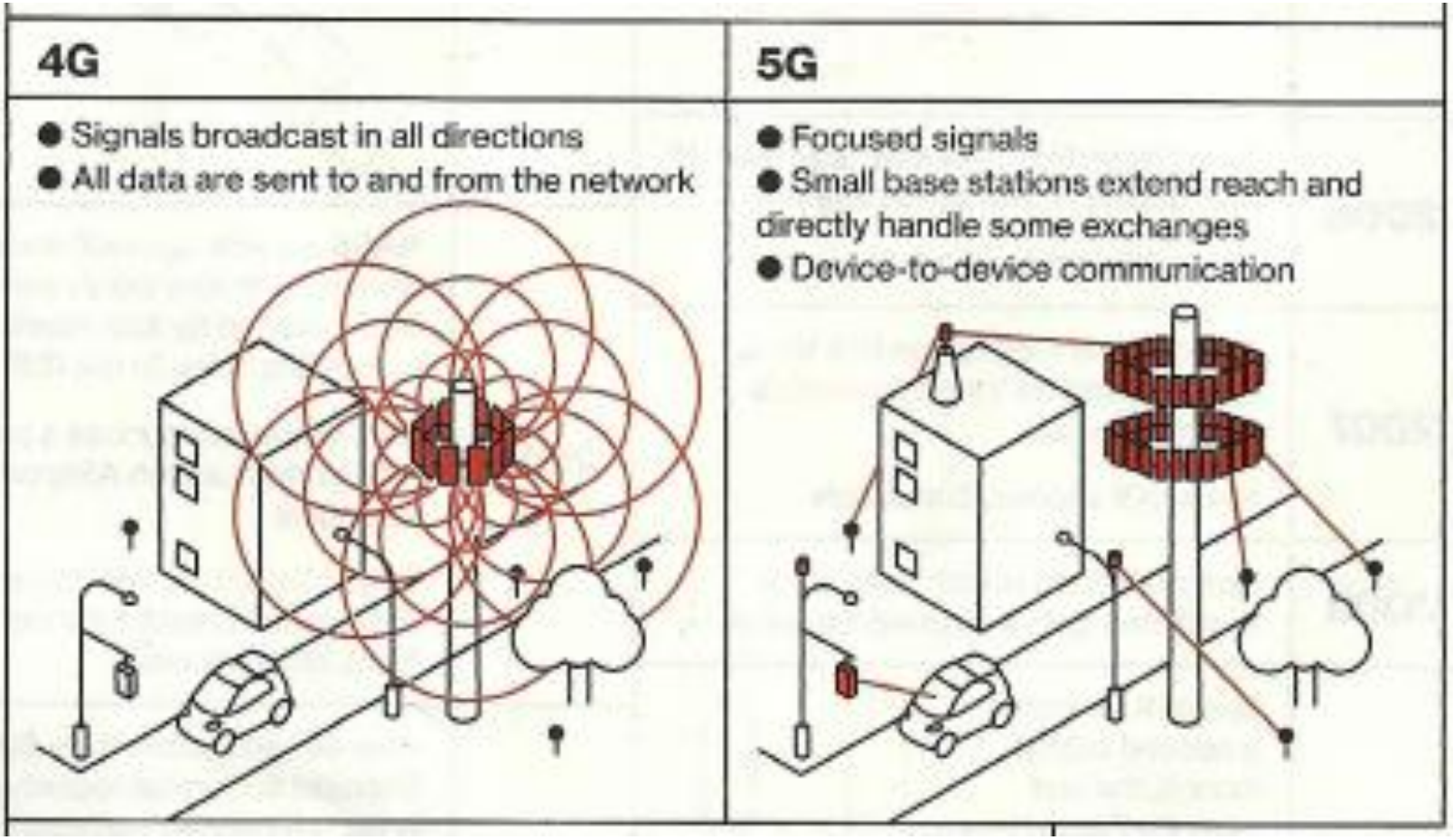
4G

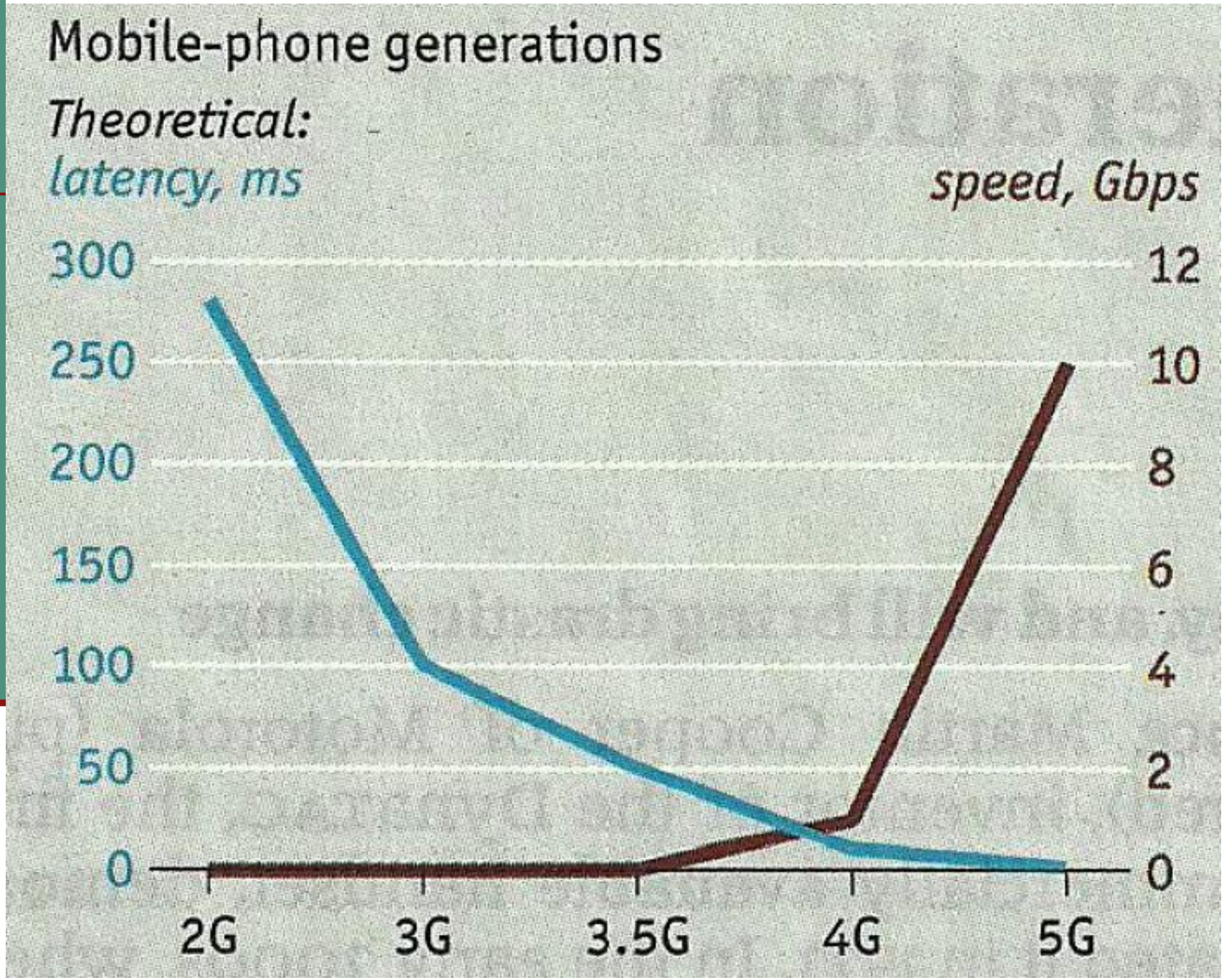
- Long-Term Evolution (a GSM standard) and Wi-Max (a IEEE Standard) are all “4G” wireless data transfer technologies
- 3G and earlier used “switched” protocol, but 4G and beyond use packet switching
- Some carriers deliver 4G via WiMax and some via LTE which have speeds up to 300Mbps
- Wi-Max and LTE have changed the last networking mile in the same way that Wi-Fi changed the last 100 feet of networking: by complementing or possibly replacing the existing technologies

5G

- **5G** (**5th generation mobile networks)** denotes the proposed next major phase of mobile telecommunications standards
- The Next Generation Mobile Networks Alliance defines the following requirements for 5G networks:
  - Data rates of tens of megabits per second for tens of thousands of users
  - 1 gigabit per second simultaneously to many workers on the same office floor
  - Several hundreds of thousands of simultaneous connections for massive wireless sensor network
  - Spectral efficiency significantly enhanced compared to 4G
  - Latency reduced significantly compared to LTE
- The Next Generation Mobile Networks Alliance feels that major 5G roll outs will begin in 2020

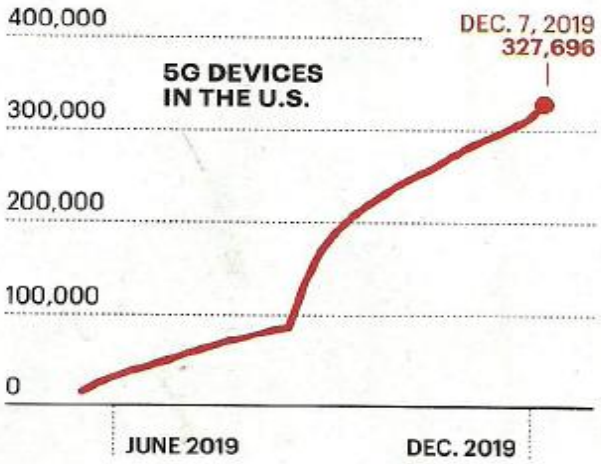
5G vs 4G




Mobile-phone generations
Theoretical:
latency, ms
speed, Gbps
300
250
200
150
100
50
0
12
10
8
6
4
2
0
2G
3G
3.5G
4G
5G

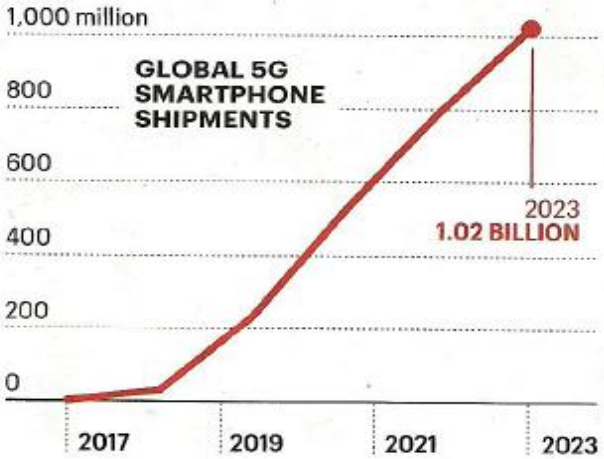
U.S. GETS STARTED

U.S. adoption of 5G has grown rapidly in the short amount of time service has been available.



GOING GLOBAL

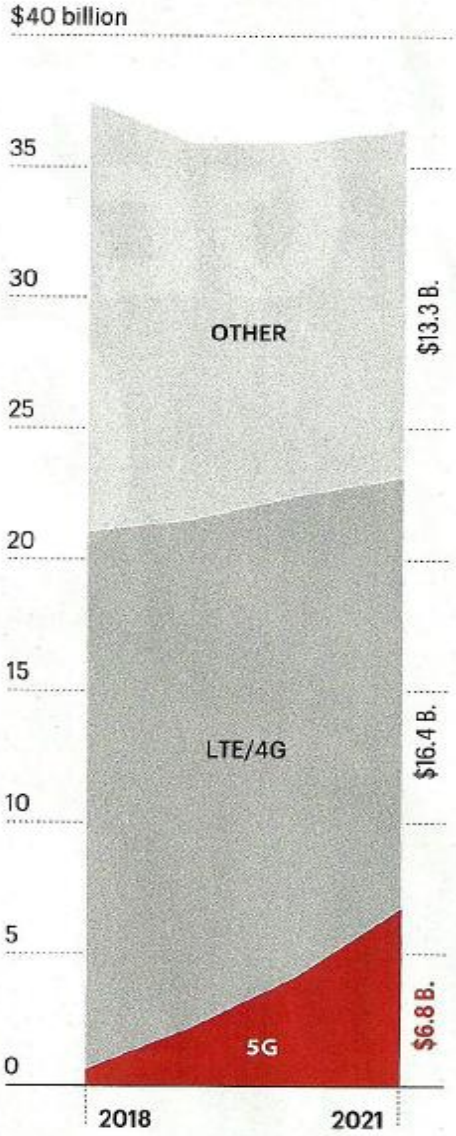
The number of people worldwide using 5G is expected to soar.



BIG UPFRONT COSTS

Spending by mobile carriers on 5G equipment and installation is climbing steadily.

GLOBAL WIRELESS INFRASTRUCTURE REVENUE FORECAST



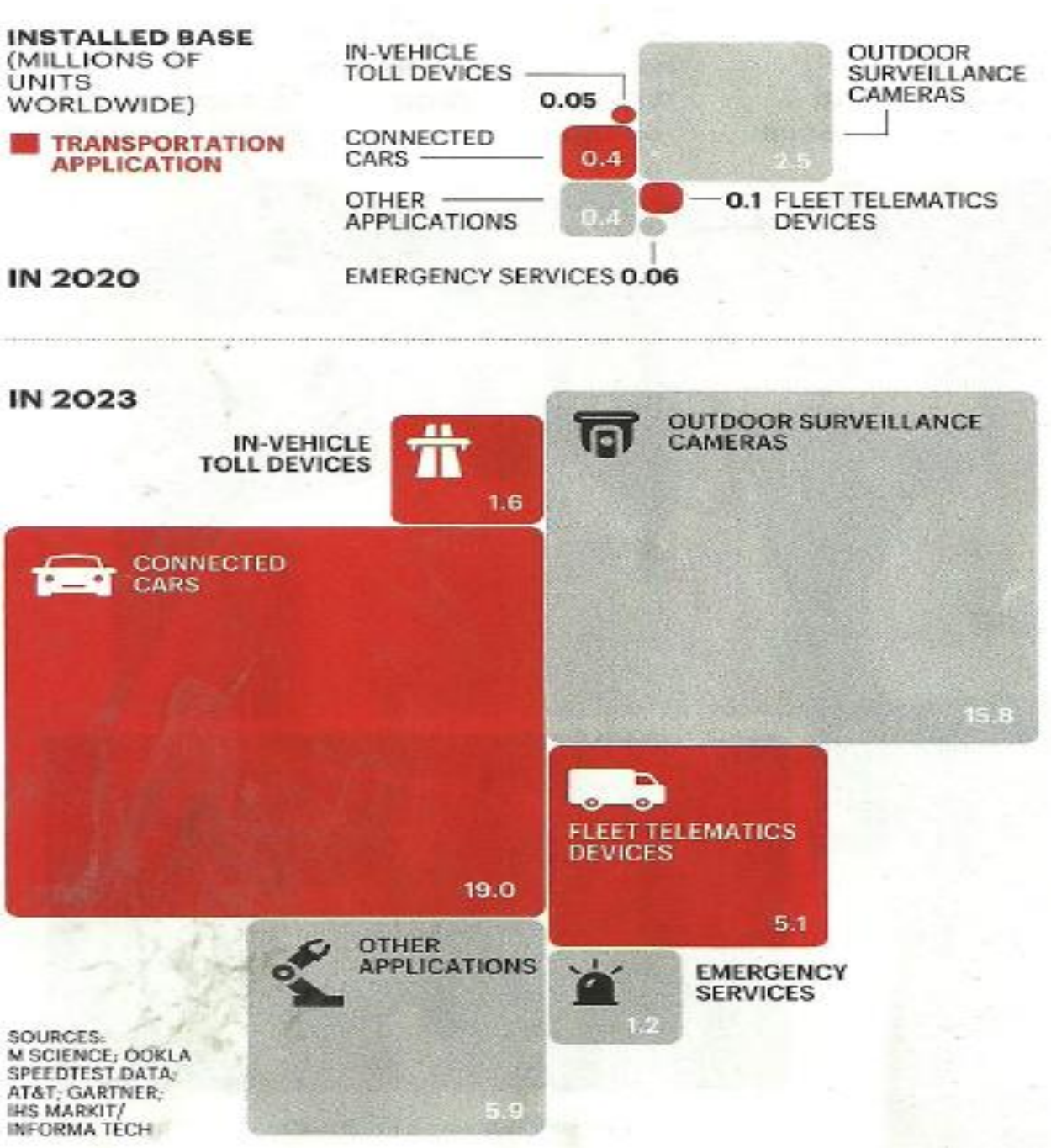
RAMPING UP SERVICE

Of the three biggest wireless carriers, AT&T currently has the fewest U.S. cities wired for 5G. But like its competitors, it's ramping up: It plans to expand across the country this year. Below are the 19 cities where AT&T presently offers coverage.

CITIES WHERE AT&T OFFERS 5G

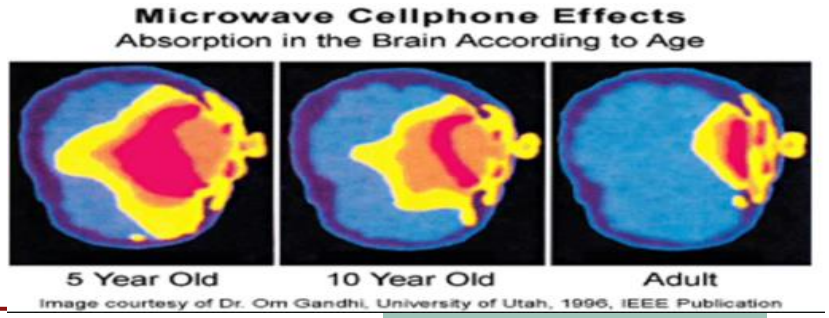
As of Dec. 27, 2019

Not Just Phones



5G Health Issues

Link to 5G Article



- **Numerous studies have found serious health issues with 5G**
- Many international medical organizations, such as the American Academy of Pediatrics, the Vienna Medical Association, and more than 20 nations, including France, Israel, Russia and Belgium, recommend reducing cell phone radiation exposure, especially for children
- Several countries such Chile and Greece have regulations that consider schools, hospitals and parks to be “sensitive areas” and do not allow cell towers to be built on these areas
- In contrast, although the Los Angeles School district has banned cell towers from its school properties, most US schools, hospitals, police stations, post offices and parks remained unprotected
- The International Association of Firefighters has officially opposed cell towers on their stations since 2004, after a study found neurological damage in firefighters with antennas on their station
- Last year, when 5G “small cells” were coming to California via a 5G streamlining bill, firefighter organizations cited these many peer-reviewed studies showing harm, and requested that 5G towers not be installed on firehouses. The firefighters were successful and the bill was amended to exempt firestations from the 5G deployment.

Local Governments Cannot Regulate Environmental Effects of Cellular Telephone Towers

The United States Court of Appeals for the Second Circuit has upheld guidelines issued by the Federal Communications Commission (FCC) setting health and safety standards on radio frequency radiation (RFR) emissions and prohibiting local governments from considering health effects of cellular tower radiation in zoning decisions.

In 1996 and 1997, the FCC issued guidelines for use in evaluating environmental effects of RFR emissions from cellular towers. The new guidelines incorporated maximum permitted exposure (MPE) limits established by the Congressionally-chartered National Council on Radiation Protection (NCRP). In addition, FCC decided to exempt certain types of towers from environmental reviews based on a presumption that these towers comply with MPEs.

While the FCC was finalizing its 1996 MPE guidelines, Congress passed the Telecommunications Act of 1996. One provision of the Telecommunications Act prohibits state and local governments from denying permit applications for cellular towers based upon the environmental effects of RFR if the FCC's guidelines are followed. The FCC then issued a rule consistent with the Telecommunications Act:

> No State or local government or instrumentality thereof may regulate the placement, construction, and modification of personal wireless service facilities on the basis of the environmental effects of radio frequency emissions to the extent that such facilities comply with the regulations contained in this chapter concerning the environmental effects of such emissions.

Airplane WiFi

- Wi-Fi signals don't travel much beyond 100 feet, so once you're in the air, the only wireless available network is from the plane
- Benefits:
  - Able to check email on long flights
  - Form of entertainment (be careful, net is monitored)
  - Works for any device that has ability to connect to Wi-Fi
  - Some flights offer free access, others charge
- There are two primary methods to enable a passenger Internet connection on an airplane:
  - Satellite
  - Air-to-ground

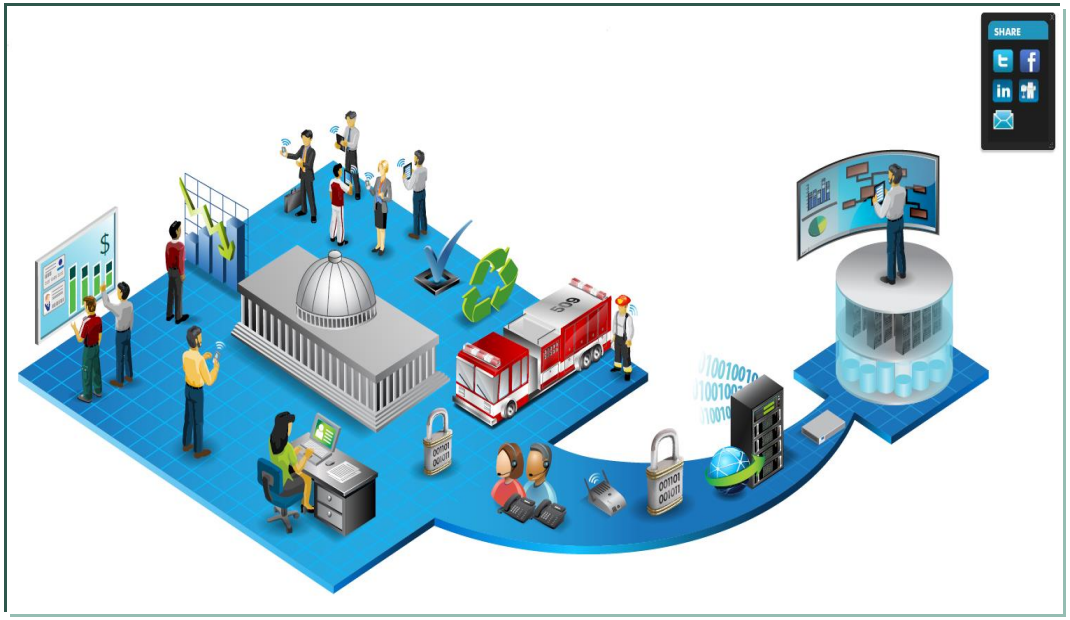
Air-to-ground

- Uses a network of ground cell towers across the continental U.S. (therefore does not work over water)
- These towers' cells are much larger than those of the typical cell towers used for phones
- Antennas are on the belly of the airplane, looks like a small fin
- As the airplane flies, the connection hands off from one tower to the next just like your phone does when you're driving
- Network infrastructure is much cheaper than satellite

Air Satellite

- Unlike air-to-ground, signals from the airplane go into space to an orbiting satellite and then down to the ground
  - These satellites are usually in geostationary orbit, 22,300 miles up
- Three types offer different levels of performance
  - L-band (slowest speed)
  - Ku-band (speed based on amount of planes connected)
  - Ka-band (in process, promised to be faster than others)
- These satellites have many transponders to support a large number of simultaneous connections

What are the major problems with cellular service ?



Don’t look ahead …

Real Problems with Cellular Service

- Areas not covered via cell towers:
  - 70% of the earth's surface – oceans
  - Rural areas
  - Deserts
  - Wilderness
  - Polar areas
- Cell towers need power
  - In a disaster (i.e. Hurricane Katrina) there is a loss of both power and some towers
- Overcrowding
- Health issues

Iridium - Mobile Phone via Satellite

Love of Wireless Smartphones & PDA's

[STUDYLOGIC LLC Commissioned by Sheraton]

- Teens would now rather go without a car rather than a smartphone
- 87 percent bring their PDA into the bedroom
- 35 percent would choose their PDA over their spouse
- 84 percent check their PDAs just before going to bed and as soon as they wake up
- 80 percent said they check their e-mail before morning coffee
- 85 percent feel the PDA allows them to spend more time out of the office
- 84 percent said the technology allows for more flexibility and time with family and friends
- 77 percent said the PDA helps them enjoy life

Smartphone Malware

- Smartphones can do many of things that computers do - even catch viruses and other malware - with millions of people storing sensitive personal information on smartphones, it's not surprising that bad guys are writing malware that targets phones
- One smartphone scam is an old one from the days of dialup modems, when hidden Trojan programs would secretly dial out to $5-a-minute sex chat lines, and a rising number of Java-based "porn dialers" are finding their way onto smartphones
  - Such a program, unbeknown to the user, can send SMS messages to premium-priced services, and the owner of the smartphone gets a very big surprise in his next phone bill

Smart Phone Security

- Password protect the device
- Add a personal PIN to avoid hacker “porting”
- Delete private info form the cache
- Do not store sensitive info, or encrypt it
- Avoid using applications that provide direct access to bank accounts, social networking accounts, and which store your credentials
- Avoid using unsecured wireless connections (public Wi-Fi) to access sensitive sites like your bank
- Use smartphone anti-malware – see next slide
- Report text message Spam to SPAM (7726)
- Seek backup/wiping services through the phone's manufacturer or your wireless provider
  - A backup program sends data on your phone to your home computer; a wiping program erases information from your phone if it is lost or stolen.
- Read your monthly statements to monitor odd activity

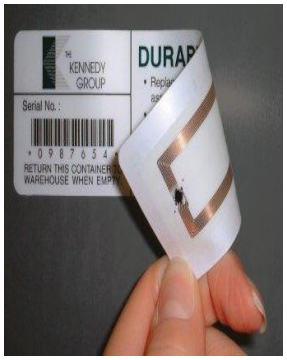
Smartphone Anti-Malware

[inexpensive – some are free]

- **Android only:**
  - **Symantec: Norton Mobile Security**
  - **Paessler: PRTGdroid**
  - **Webroot: Mobile Security**
  - **Trend Micro: Mobile Security for Android**
  - **AVG Mobilation for Android**
  - **Creative Apps: Antivirus Free**
  - **Aegis Lab: AppScan Beta**
- **Accellion Mobile Apps for** iPhone, iPad, Android and BlackBerry
- **McAfee WaveSecure for** BlackBerry, Android, Symbian OS, Windows Mobile, Java
- **Kaspersky Mobile Security 9 for** BlackBerry, Android, Symbian OS, Nokia
- **Lookout Mobile Security for** Android, BlackBerry, Windows Mobile

Radio Frequency Identification

- **RFID Technology** allows manufacturers to attach tags with antennas and computer chips on goods and then track their movement through radio signals
- **Auto-ID** creates a network that connects computers to objects, an **Internet of "things"**
- This Internet of things provides the ability to track *individual* items as they move from factories to store shelves to recycling facilities

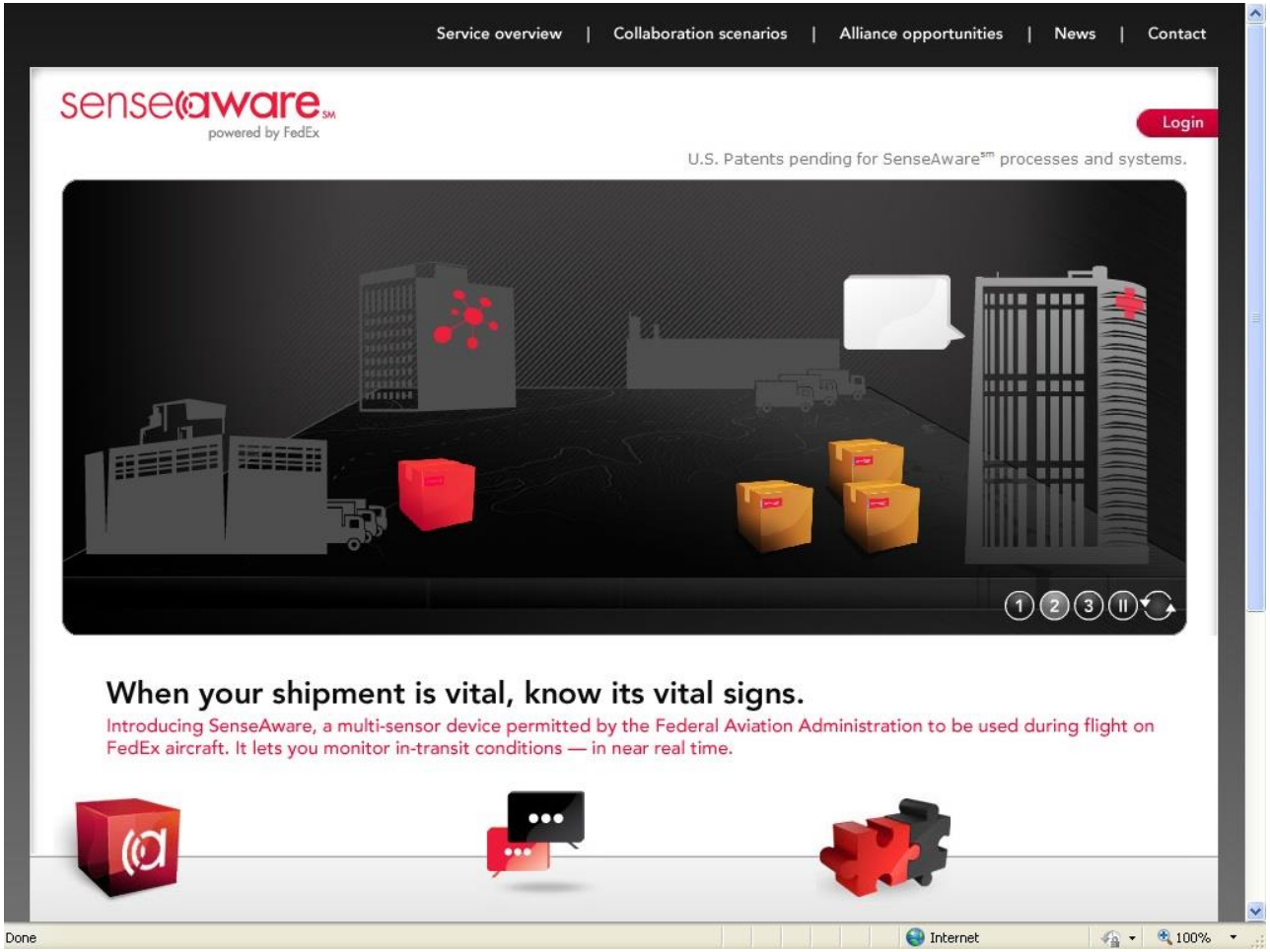


Wireless Sensor Networks (WSNs)

- **Wireless Sensor Networks** are networks of interconnected, battery-powered, wireless sensors called *motes* that are placed into the physical environment
  - **Motes** collect data from many points over an extended space
  - Each **mote** contains processing, storage, and radio frequency sensors and antennas
  - **Motes** provide information that enables a central computer to integrate reports of the same activity from different angles within the network
  - **Motes send more data than RFID (time, temperature, light, etc.)**

Fedex Senseaware

[http://www.senseaware.com/]



There's an App for that…

- Revenue from apps on mobile devices in US: started at about $2 billion in 2010
- Grew to to $50 billion by 2017
- Tremendous future job market in mobile Apps:
  - Innovation
  - Design
  - Development

Mobile Application Development

- Lots of jobs - 34% growth rate for next 10 years
- Starting salaries of $70,000 thru $110,000

Mobile Commerce

- **Mobile computing** refers to real-time, wireless connection between a mobile device and other computing environments, such as the Internet or an intranet
- They have 2 major characteristics that differentiate it from other forms of computing:
  - **Mobility –** users carry a mobile device and can initiate a real-time contact with other systems from wherever they happen to be
  - **Broad reach** – users can be reached instantly when they carry an open mobile device

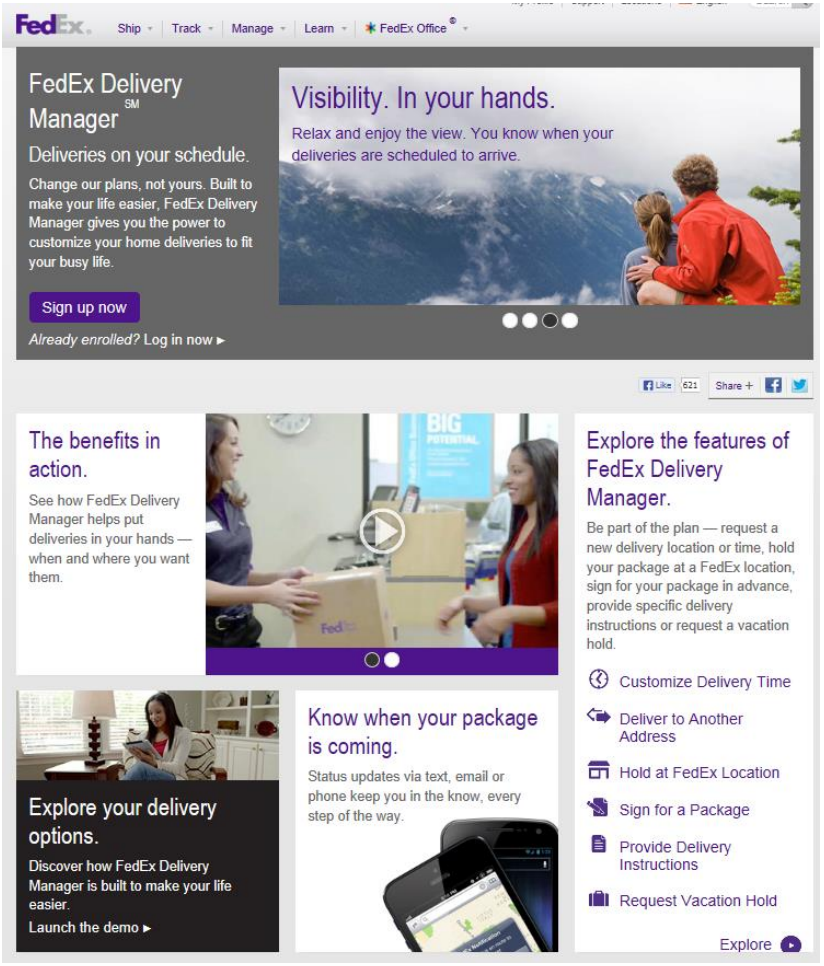
Mobile Commerce (Con't)

- The 2 characteristics, **mobility** and **broad reach**, create five value-added attributes that break the barriers of geography and time:
  - **Omnipresence** is the ability to be present in every place at any, and/or every, time; unbounded or universal presence (it is related to the concept of ubiquity, the ability to be everywhere at a certain point in time)
  - **Convenience**
  - **Instant connectivity**
  - **Personalization**
  - **Localizations of products and services**

The Future - Mobile Commerce Applications

- **Financial Services**
- **Mobile Banking**
- **Wireless Electronic Payment Systems**
- **Micropayments**
- **Mobile (Wireless) Wallets**
- **Wireless Bill Payments**
- **Shopping Services**
- **Location Based Services**

FedEx Delivery Manager



Banking Transaction Costs

- Branch - $4.00
- Call Center - $3.75
- IVR (voice response) - $1.25
- ATM - $0.85
- Online - $0.17
- Mobile - $0.08 (incl. remote deposit from smart phone)

Mobile Deposit

Protection in Online Banking

- Password protect your smartphone
- Use an app, rather than the web or texting
- Get the app from an official app store, and verify that the developer matches your bank
- Make sure the app uses multi-factor authentication
- iPhones are more secure that others
- If smartphone is lost, wipe all data and contact your bank to deactivate their app for you

GUEST COLUMN

WHAT THE SHIFT TO DIGITAL BANKING MEANS FOR BUSINESS OWNERS

The COVID-19 pandemic has had a significant impact on the shift to digital banking. With social distancing rules, self-isolation, quarantining, and working remotely, business owners have had to reconfigure the way they conduct business.

Early on in the pandemic, Paragon, like other banks, experienced clients calling in to learn more about online services such as bill pay, because people were quarantined at home and their business checks were in the office. Businesses had to set up direct deposit to get payroll out to employees working from home, and some clients wanted to cut down or eliminate their check and cash handling to accept contactless credit cards and offer ACH invoice payments.

Each of these was happening at some level before COVID-19, but the pandemic has sped up the transition tremendously. As the digital landscape continues to evolve, the banking industry and business owners face a new challenge: What does the shift to digital banking mean for business banking relationships?

Mark Nance is VP of Treasury Management Sales for Paragon Bank

BANKS AND BUSINESSES WILL ADJUST TOGETHER

It's true that businesses are taking longer than personal banking customers to transition to digital services. One reason is that the original technology was more geared toward consumer adoption, whereas only recently have digital services evolved to allow businesses the functionality they require. This sophistication combined with COVID-19 have pushed the pace of adoption into high gear.

As digital banking continues to grow, small businesses will feel the impact. There will certainly be a learning curve to figure out how best to use and manage the various digital payment avenues, but businesses won't be left to navigate these new waters alone. Your bank will lead the way in adjusting to new norms and making sure you're set up for success. The improved cash forecasting, faster payment receipt, and improved customer experience you'll find with online banking will produce dividends that will be well worth the effort and investment of time and capital.

STILL A PERSONAL BUSINESS

As the pandemic continues its upheaval, in-person visits have been curtailed. But many banks already have powerful mobile banking apps and online banking tools. This allows business owners to create person-to-person transfers and initiate ACH transactions and wires all from the palm of their hand or the click of a mouse.

The move to digital banking does reduce a business's reliance on their bank for day-to-day transactions, but having a strong relationship with your bank is more important now than ever. With all the changes going on, it is important to have a trusted bank adviser who can offer advice.

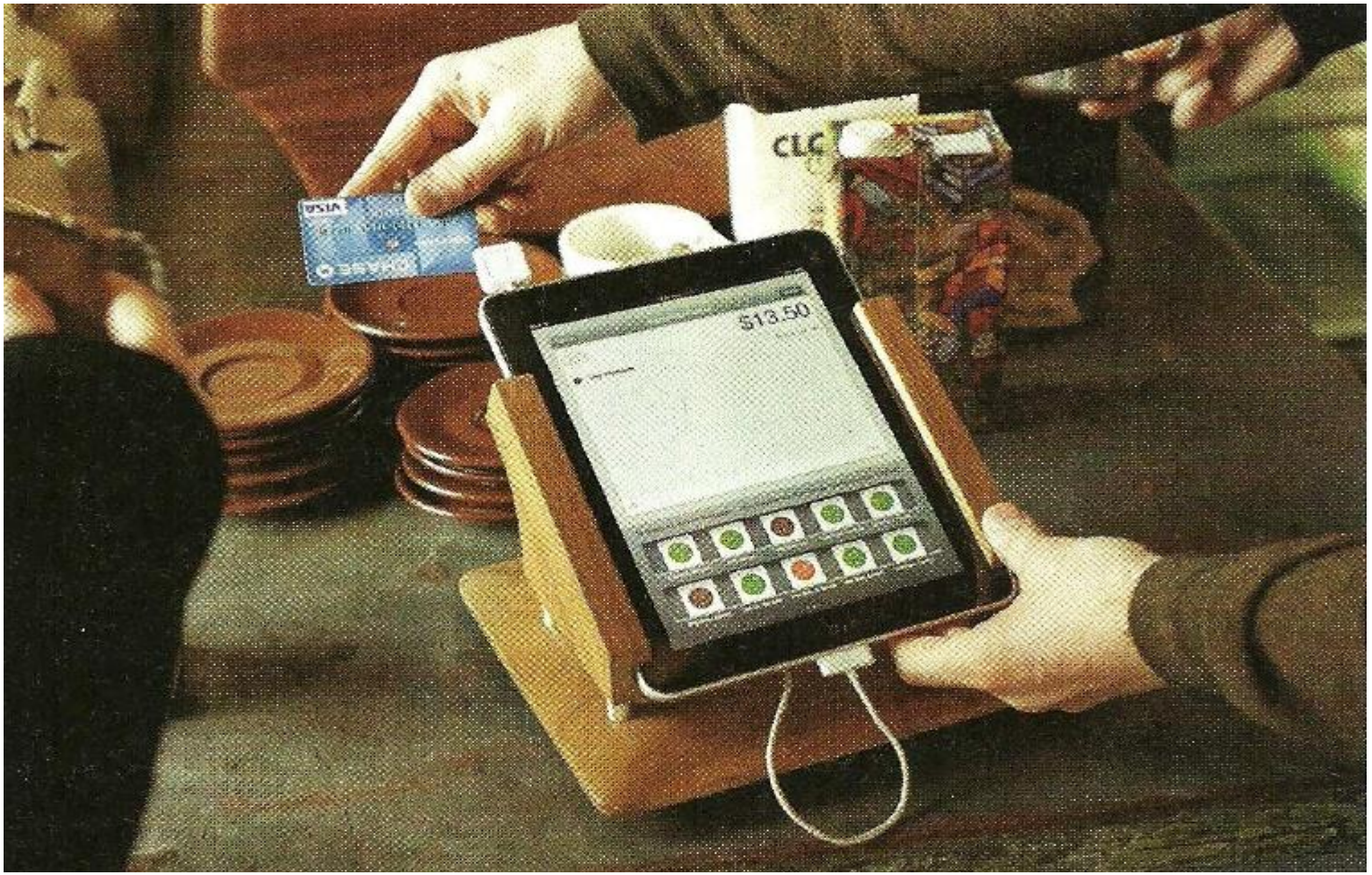
The banking industry is constantly looking for the next innovation or way to improve on our current offerings so we can keep our clients ahead of the game. Community banks traditionally have a close relationship with their clients, which makes it easy to reach out directly when we find a new method to improve a process or keep their accounts secure.

With change comes opportunity. So many aspects of daily life have been changed by COVID-19. Even after there is a vaccine, we expect many of these changes will remain. With the introduction of Real Time Payments and the formation of the U.S. Faster Payments Council, there is promise to see sweeping changes to how businesses conduct banking operations.

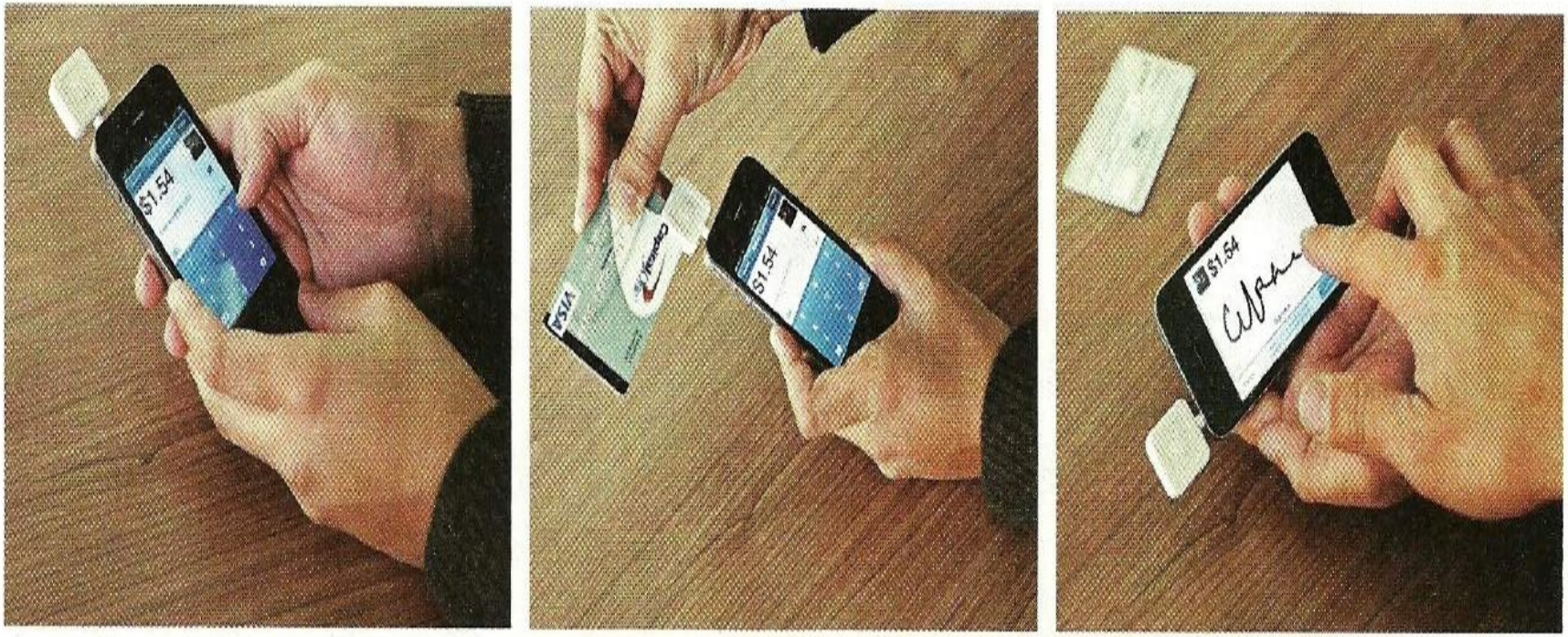
Now is the time to have a trusted adviser on your side who is experienced in navigating digital banking relationships. The businesses in position to take advantage of the changes in our ever-evolving digital world will be the ones who will find the greatest success.

Merchant Mobility

Merchant Mobility via IPad



Merchant Mobility via IPhone



A user demonstrates how Square works: The card reader fits into the phone's audio jack. The vendor slides the card through the magnetic reader, the card-holder provides a signature on the phone's touchscreen, and the transaction is processed in less than 60 seconds (if the wireless connection is good).

Intuit's GoPayment [http://gopayment.com/]

NFC (Near Field Communication)

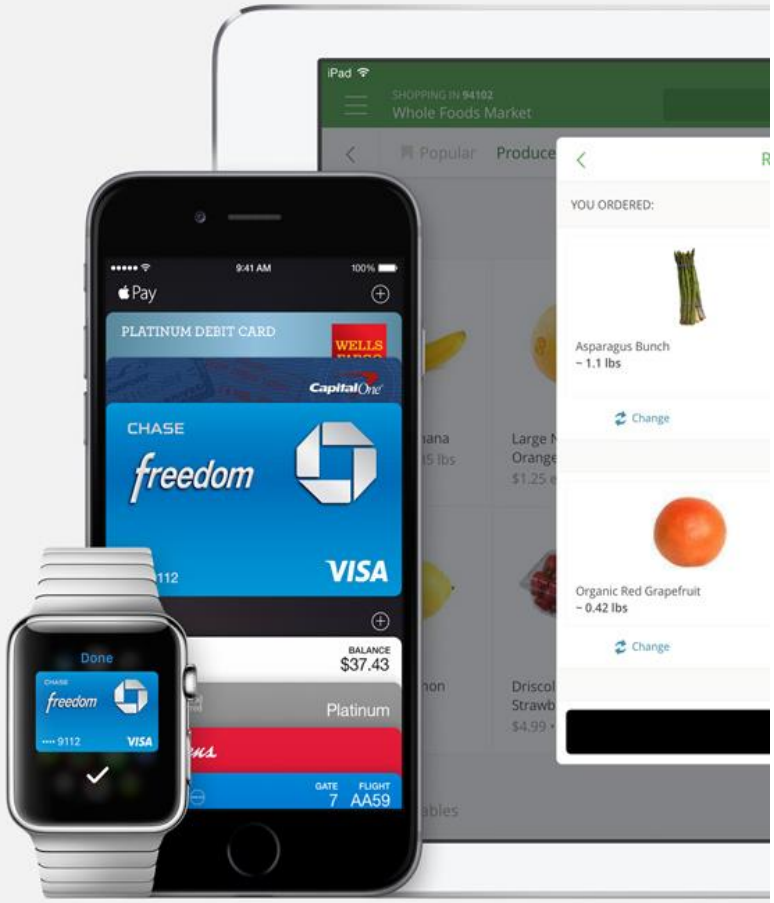
- In 2011 Starbucks allowed customers to pay via a smart phone app that displays a bar code for scanning
- But in the near future NFC will replace that technology
- Google phones, the next Iphone, and new Blackberrys will likely have NFC chips
- Already in use in Europe
- Credit card companies, cell phone companies, and communication companies fighting for pieces of this pie

Apple Pay

Your wallet.
Without the wallet.

Paying in stores or within apps has never been easier. Gone are the days of searching for your wallet. The wasted moments finding the right card. Now payments happen with a touch.

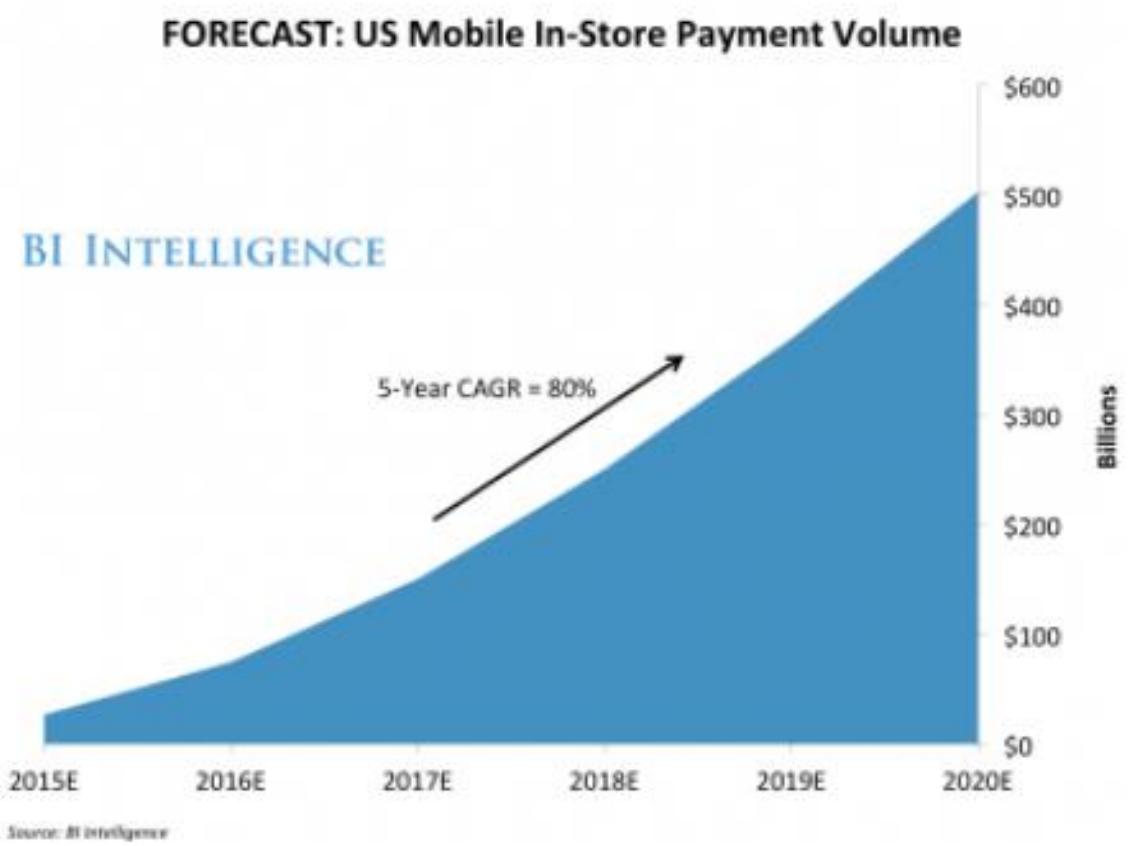
Apple Pay will change how you make purchases with breakthrough contactless payment technology and unique security features built right into the devices you have with you every day. So you can use your iPhone, Apple Watch, or iPad to pay in a simple, secure, and private way.



Average Tender Times

- Checks 64 seconds
- Credit/Debit 48
- PIN Debit 44.4
- Cash 28.5
- Biometrics 15.6
- **Contactless 12.5**

In-store Mobile Payments



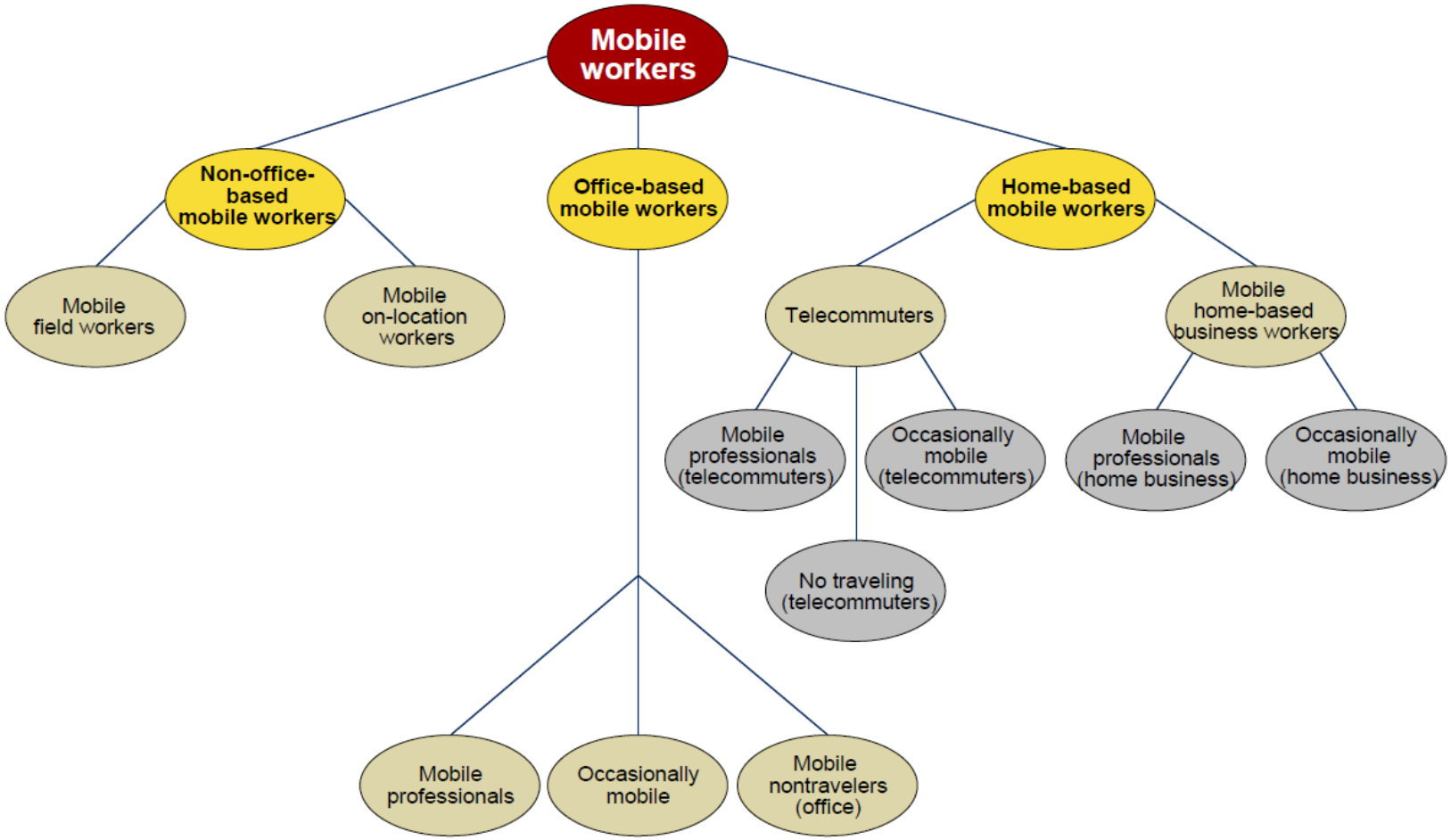
Location-based Applications

- **GPS coordinates plus GIS context layer**
- **Location-based Advertising** is when marketers know the current locations and preferences of mobile users, they can send user-specific advertising messages to wireless devices about nearby shops, malls and restaurants
- **Location-based Services** provide information to customers about local services and conditions via cell phones

Bag Tracking via SmartPhone

- Airline lose your bag? Some carriers (i.e. Southwest and Delta), allow one to track it as it heads for Seattle or Charlotte or wherever you weren't going
- Passengers get a tracking number when they check their bags and can follow the bag's progress with smartphones or laptops/tablets
- If a bag is lost, one can even submit their claim via a smartphone
- The new service comes as the FAA is about to require airlines to pay higher fees if they lose bags

Types of Mobile Workers



References

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- Mobile Commerce Application Development by Lei-da Chen and Gordon Skelton
- Encyclopedia of Mobile Computing and Commerce by David Taniar
- Wireless Communications and Mobile Commerce by Nansi Shi
- M-commerce: Global Experiences And Perspectives by Nikhilesh Dholakia, Morten Rask, and Ruby Roy Dholakia
- Internet-Enabled Handheld Devices, Computing, and Programming: Mobile Commerce and Personal Data Applications by Wen-Chen Hu
- Handbook of Mobile Commerce by Stephan Olariu and Doru Eugen Tiliute

Homework

- Textbook Chapter 9
- Quiz on this lesson and that chapter
- Deliverables for ABC case study:
  - How can ABC utilize mobile technology
- Download (from online syllabus page) and read "McDonalds IT"
  - Email a written discussion of ideas you got from this article that could be used for a competitive advantage in your team's chosen business
- Team Report 4 - E-Commerce
  - Web Site Design (planning questions and design diagram)