


GROUP 12 PROJECT 9A

ENERGY USAGE OF THE INTERNET INDUSTRY
WINTER 2013



COREY IRELAND
MARTIN MILLER
JASON SMITH
BRENDAN VINCELLI

ChrisHansen.net

INTRODUCTION


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The internet is used by billions of people around the world.

At any second, terabytes of data are being exchanged.

This has created an energy crisis with complex philosophical and ethical questions:

Who is responsible for powering this demand?



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INTRODUCTION

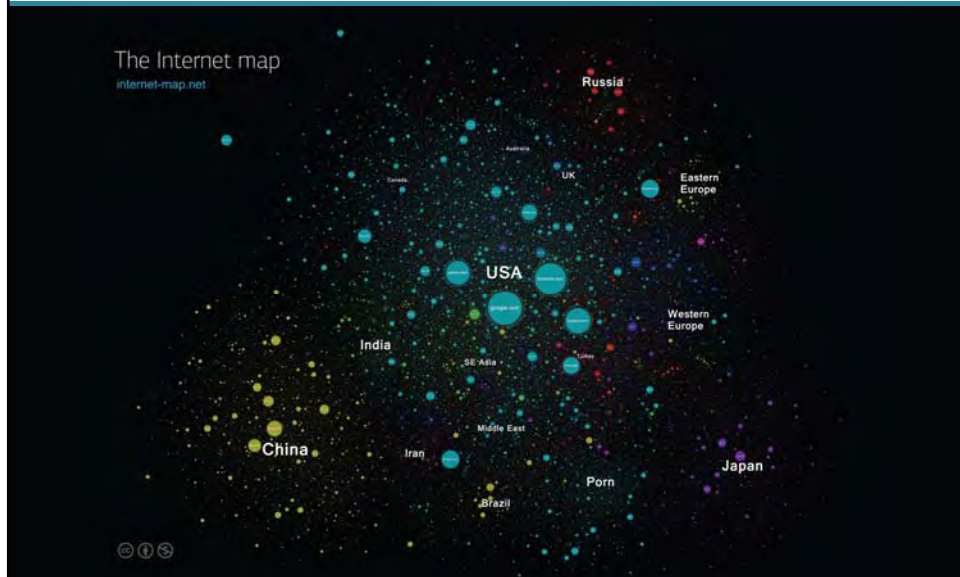
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This presentation will discuss:

- Who is drawing the most energy?
- How does internet use affect energy demand?
- What are they doing about it?



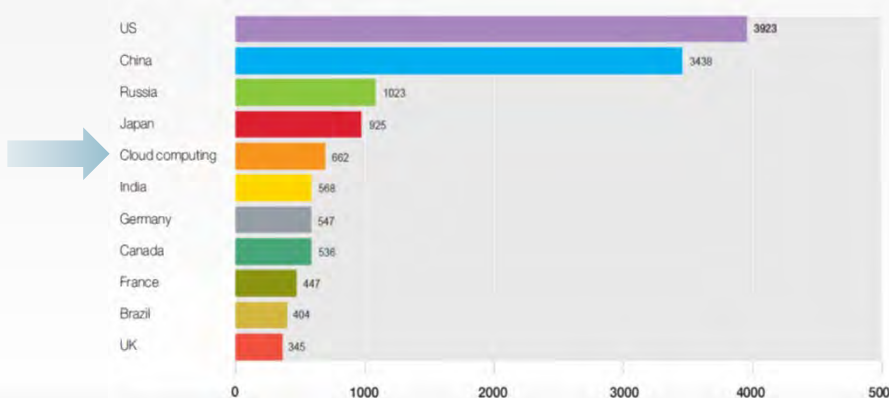
WHO IS USING ENERGY?



ONLINE ENERGY

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2007 electricity consumption. Billion kWh



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GROWTH

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	Servers			Storage (BkWh yr ⁻¹)	Commu- nications (BkWh yr ⁻¹)	Infra- structure (BkWh yr ⁻¹)	Total/avg (BkWh yr ⁻¹)	Power (GW)	% of total
	Volume (BkWh yr ⁻¹)	Mid-range (BkWh yr ⁻¹)	High-end (BkWh yr ⁻¹)						
2000									
US	8.0	2.5	1.1	1.1	1.4	14.1	28.2	3.2	40%
Western Europe	5.3	1.7	0.6	0.7	0.9	9.2	18.3	2.1	26%
Japan	1.8	0.9	0.6	0.3	0.4	4.0	8.1	0.9	11%
Asia Pacific (ex. Japan)	2.3	0.5	0.1	0.3	0.3	3.5	7.0	0.8	10%
Rest of World	2.3	1.2	0.3	0.4	0.4	4.6	9.2	1.0	13%
Total	19.7	6.7	2.8	2.8	3.4	35.4	70.8	8.1	100%
% of total	28%	9%	4%	4%	5%	50%	100%		
2005									
US	18.9	2.1	1.5	2.7	2.7	28.0	56.0	6.4	37%
Western Europe	13.7	1.9	1.1	2.0	2.0	20.7	41.3	4.7	27%
Japan	4.6	1.0	0.9	0.8	0.8	8.0	16.1	1.8	11%
Asia Pacific (ex. Japan)	7.0	0.7	0.3	1.0	1.0	9.9	19.9	2.3	13%
Rest of World	6.2	1.0	0.5	0.9	0.9	9.6	19.2	2.2	13%
Total	50.5	6.7	4.2	7.5	7.3	76.2	152.5	17.4	100%
% of total	33%	4%	3%	5%	5%	50%	100%		
Total 2005/2000	2.56	1.00	1.50	2.70	2.15	2.15	2.15	2.16	

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COMPANIES

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Company	Number of Servers
Google	900,000
Hewlett-Packard	380,000
Microsoft	218,000
OVH	120,000
Intel	75,000
Facebook	60,000
Amazon	40,000

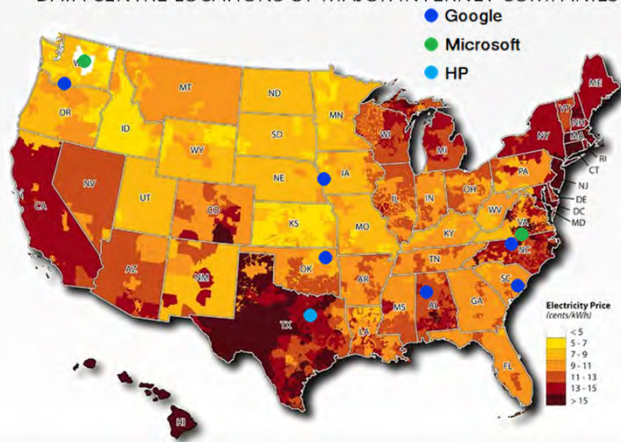


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WHERE ARE USERS?

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DATA CENTRE LOCATIONS OF MAJOR INTERNET COMPANIES

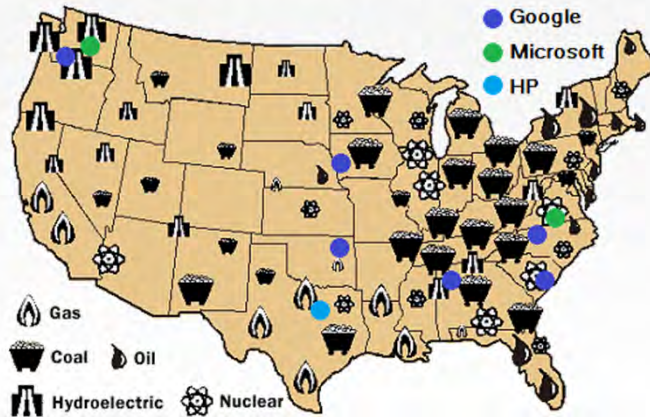


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WHERE ARE USERS?

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DATA CENTRE LOCATIONS OF MAJOR INTERNET COMPANIES



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HOW IS ENERGY USED?



GOOGLE DATA CENTRE
COUNCIL BLUFFS, IOWA

HOW IS ENERGY USED?

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Energy is used powering:

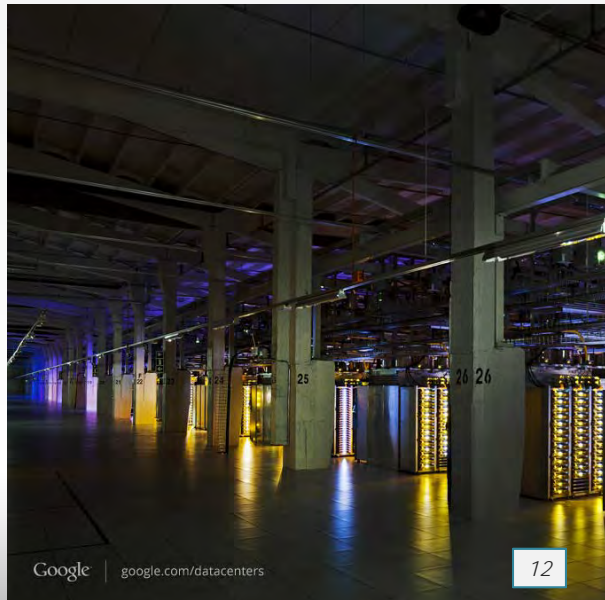
- Data centres
- Server operation
 - Server cooling
- Internet companies
- Infrastructure
- End users



DATA CENTRES

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- “Where the internet lives”
- Buildings where thousands of servers are operated
- Account for 1.5% of global electricity usage



SERVER POWERING

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Typical server power demand:
500W

Typical household refrigerator:
500-1000W

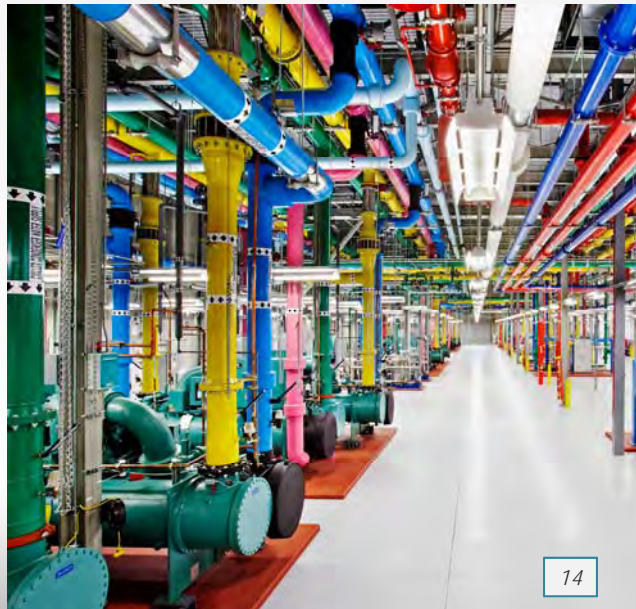
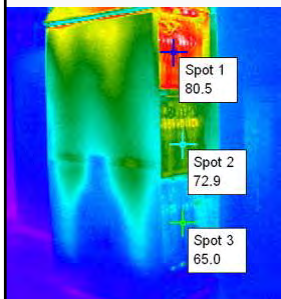
Most servers run 24 hours a day

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SERVER COOLING

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- Servers require significant cooling
- Air or liquid cooling
- Typical load of 100W/server



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WHAT COMPANIES ARE DOING

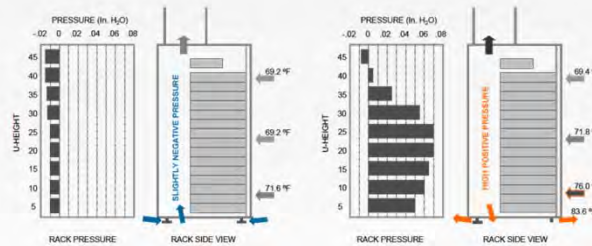


ENERGY SAVINGS

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More efficient cooling techniques:

- Efficient ventilation
- Use of liquid cooling
- Use of the local climate



Google's data centre in Hamina, Finland, uses seawater to keep servers cool.



ENERGY PRODUCTION

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Internet companies are

- Investing in renewable energy
- Experimenting with new forms of energy production

Google's experimentation with parking lot solar panels



Google's wind farm in Iowa



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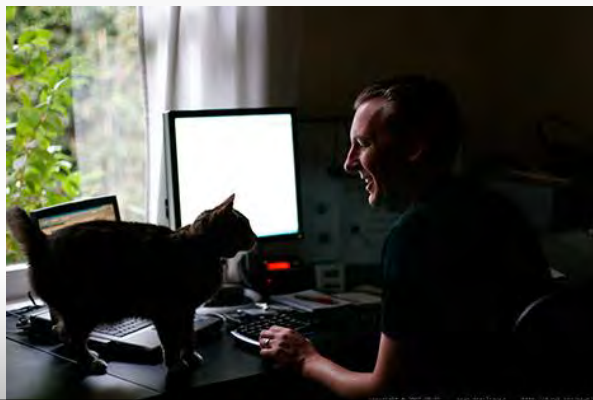
TELECOMMUTING

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- Possible *because* of the internet
- "Commute" to work over the internet
- Reduce energy consumption from travelling

2003 Japanese study suggested telecommuting by people in sales or technical fields would reduce national energy consumption by 1%.

REMINDER: Data centres are for 1.5% of world's electricity usage.



CONCLUSION



CONCLUSION

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- The internet is an historic technological development
- Powering the internet relies primarily on fossil fuels
- Major companies are gradually investing in energy efficient technology and renewable energy
- People who use the internet can contribute by telecommuting

