Introduction to Emerging Technology (ET)

Chapter 1

Learning Outcomes

After completing this lesson you should be able to

- Develop knowledge about industrial evolutions
- Identify the technological advances that made the industrial revolution possible
- Explain the role of data in Emerging Technologies
- Identify enabling devices for emerging technologies
- Understand concepts relating to the design of human-computer interfaces
- Describe future trends of Emerging Technologies

Definition of Emerging Technologies

Refers to **technologies that are currently developing**, or that a**re expected to be available** within the next five to ten years

Technological evolution is a theory of radical transformation of society through technological development

What is a technology?

- Technology vs science

1. The information systems of an organization consist of the information technology infrastructure, data, application systems, and personnel that employ IT to deliver information and communications services in an organization.
2. Meanwhile, the term information systems also refers to the management of the organizational function in charge of planning, designing, developing, implementing, and operating the systems and providing services.
3. Thus, the concept of IS combines both the technical components and human activities within the organization as well as describes the process of managing the life cycle of organizational IS practices.
4. Due to the increasing importance of IS to the organization, understanding the strategic value of information systems has not only been the top goal of many IS practitioners .

What do others think?

Conferences? And Books?

Conferences

O'REILLY

EMERGING TECHNOLOGY CONFERENCE

The Westin Horton Plaza, San Diego, CA • February 9-12, 2004

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SEE THE FUTURE
SHAPE THE FUTURE

We're excited to invite you to the third annual O'Reilly Emerging Technology Conference

The O'Reilly Emerging Technology Conference recognizes that computing innovations are coming down the pike at an extraordinary rate, from not-necessarily traditional sources, heading in unforeseen directions, and being used in unexpected ways. While the initial impact of these innovations may seem small, their ripple effects can have a huge impact in the larger computing arena.

Two of the main themes explored at this year's conference will be mobility, because the devices people spend more time interacting with -- laptop, palmtop, and hiptop -- are dramatically changing the way we utilize data and services; and social software, which represents and supports groups of people weaving online representations of their connections and interactions. Other important themes include: personal area networks, creating an untethered world of ad hoc WiFi, Bluetooth, and cellular networking; navigational devices, geospacial annotation tools, and visualization software, which are throwing new light on the landscape; and hardware, which, like software, is driven by Moore's Law, with hackers cracking open their devices to poke, prod, and repurpose.

Examples

- IRobot Co-Founder Helen Greiner builds robotic vacuum cleaners and tunnel-searching military robots, and is working on the next Mars rover.
- Marc Smith of Microsoft demonstrates tools that catalyze collective action by highlighting participants' histories and relationships.
- Xbox hacker Andrew "Bunnie" Huang teaches reverse engineering techniques.
- Russell Beattie develops mobile applications for phones and PDAs.
- Nokia's Matt Jones uses User-Centered Design and participatory product development.
- Eric Bonabeau explores how evolutionary computation can be used to detect weaknesses in complex systems.
- The Walt Disney Internet Group leverages RSS for collaboration and massive content delivery.
- The BBC's Priya Prakash analyzes the impact of wireless service in emerging markets.
- Author and researcher J.C. Herz examines how emerging technologies are percolating through the Pentagon.
- Professor of Economics Edward Castronova looks at the future of cyberspace economies.
- Journalist Danny O'Brien studies Life Hacks, the tech secrets of over-prolific alpha geeks.
- Fiona Romeo creates social software for children at the BBC.
- GeoURL's Joshua Schachter annotates the landscape with geospacial markup and distributed geographic annotation.

MIT Emerging Technologies Conference

http://www.etc2003.com/conf_prog.shtml

List of Recently Emerged Technologies

- Artificial Intelligence
- Blockchain
- Augmented Reality and Virtual Reality
- Cloud Computing
- Internet of Things (IoT)
- Intelligent Apps (I-Apps)
- Big Data
- Robotic Process Automation (RPA)

Industrial Revolution (IR 1.0) - 1760s

Going from **hand production methods to machines**

The increasing use of **steam power**

The development of **machine tools** and the rise of the **factory system**

Industrial Revolution (IR 2.0) - 1870s

Also known as the Technological Revolution

Development of methods for **manufacturing interchangeable parts**

Widespread adoption of pre-existing technological systems such as telegraph and railroad networks

Introduction of **Electric Power** and **Telephone**

Industrial Revolution (IR 3.0) - 1950s

The transition from mechanical and analog electronic technology to digital electronics

Also referred as **Digital Revolution**

Mass production and widespread use of **digital logic circuits** and its derived technologies such as the **computer**, **handphones** and the **Internet**

Fourth Industrial Revolution (IR 4.0)

Emergent of **cyber-physical system**

A mechanism that is controlled or monitored by computer-based algorithms, tightly integrated with the Internet and its users

Automated Robots, Internet of Things, additive manufacturing and autonomous vehicles

Adoption of Artificial Intelligence

Role of data for Emerging Technologies (ET)

Data is regarded as **the new oil** and **strategic asset** and it drives or even determines the future of

science, technology, the economy ...

Understanding, **exploring**, and **utilizing data** is reshaping the world and introducing a paradigm shift

Data science and **analytics** enables **data-driven theory**, **economy**, and **professional development**

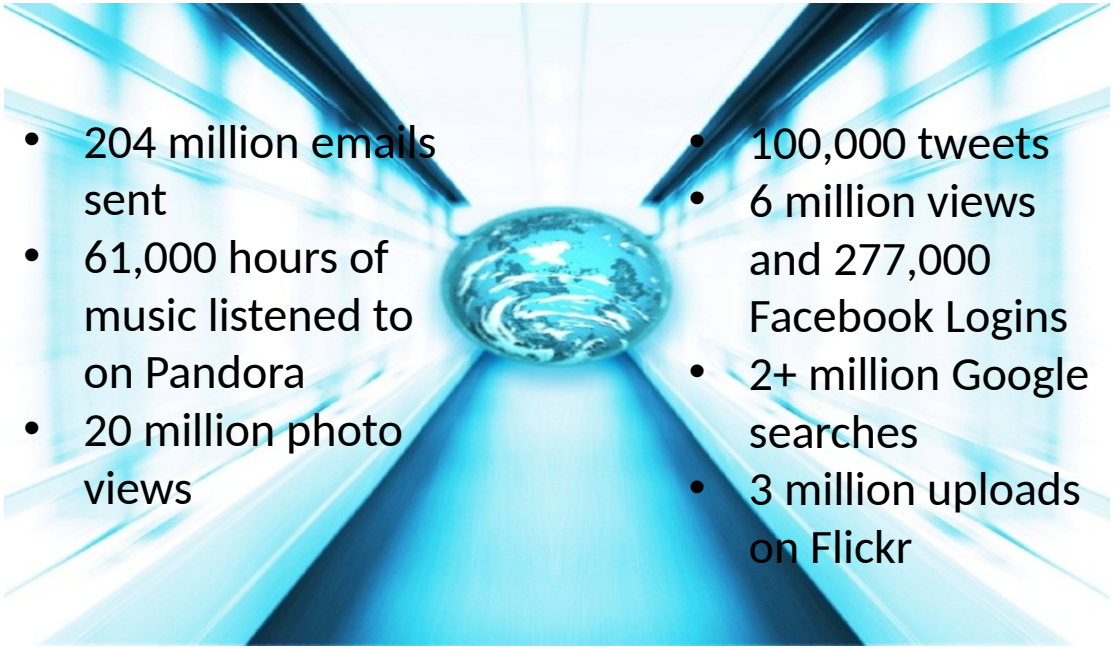
Role of data for Emerging Technologies (ET)

Impacts not only data related disciplines such as computing, informatics, and statistics but also

the broad fields of **business**, **social science,** and **health/medical science**

Emerging Technologies-Big Data

In the last minute there were…..



- 204 million emails sent
- 61,000 hours of music listened to on Pandora
- 20 million photo views
- 100,000 tweets
- 6 million views and 277,000 Facebook Logins
- 2+ million Google searches
- 3 million uploads on Flickr

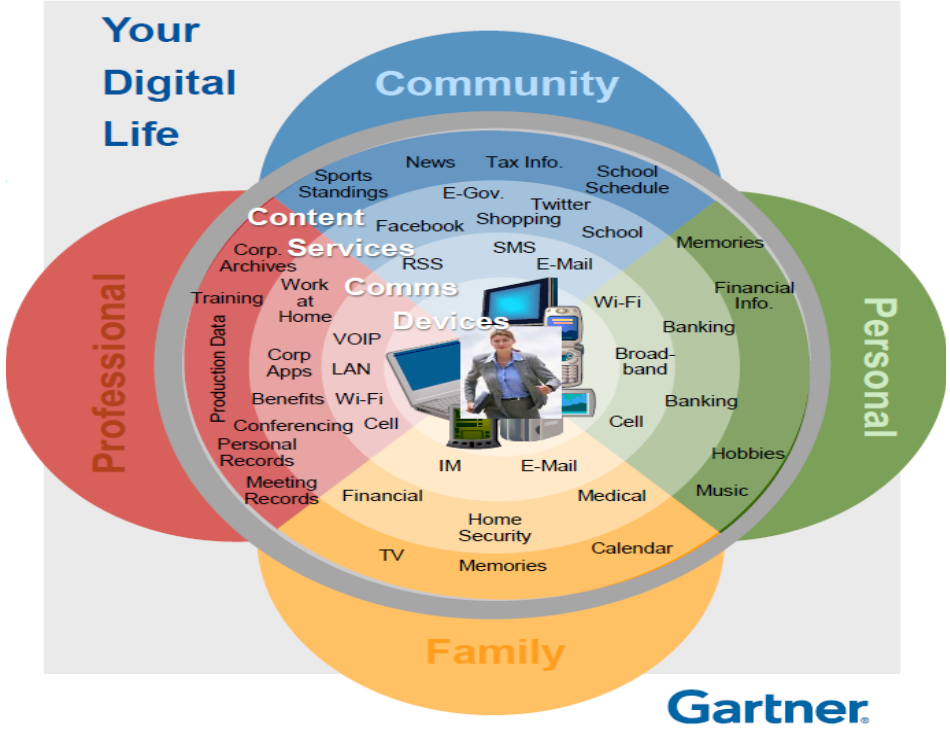
…and that's nothing to what's coming

Emerging technologies will change everything – how we work, how we live, how we communicate

And maybe another one

- Customer/User Centric approaches

Leveraging mobile, social media, cloud & big data/analytics organisations will put customers/users even more effectively at the centre of their approaches



Emerging technologies will change everything – how we work, how we live, how we communicate

What implications do the Emerging Technologies themselves have for organisational capabilities?

Top 10 Strategic Technology Trends for 2013

1. Mobile Devices Battles
2. Mobile Applications & HTML5
3. Personal Cloud
4. Internet of Things
5. Hybrid IT & Cloud Computing
6. Strategic Big Data
7. Actionable Analytics
8. Mainstream In-Memory Computing
9. Integrated Ecosystems
10. Enterprise App Stores

Strategy: CIOs see Digital Technologies in combination rather than isolation.

	Mobile	Big Data/Analytics	Social Media
Mobile	17% Only Mobile	18% Both Mobile and Big Data	17% Both Mobile and Social Media
Big Data/ Analytics		11% Only Big Data	8% Both Big Data and Social
Social Media	21% All Three Technologies		8% Only Social Media

It becomes even more important to be able to deploy technology capabilities integrated across technologies

Integrated technology teams? Integrated technology & business teams?

Enabling device and networks for emerging technologies

- In the world of digital electronic systems, there are four basic kinds of devices: memory, microprocessors, logic and networks.
  - Memory devices store random information such as the contents of a spreadsheet or database.
  - Microprocessors execute software instructions to perform a wide variety of tasks such as running a word processing program or video game.
  - Logic devices provide specific functions, including device-to-device interfacing, data communication, signal processing, data display, timing and control operations, and almost every other function a system must perform.

Enabling device and networks for ET

Four basic kinds of devices

Memory

store information such as the contents of a spreadsheet or database

Microprocessors

execute software instructions to perform a wide variety of tasks such as running a word processing program or video game

Enabling device and networks for ET

Four basic kinds of devices

Logic Devices

provide specific functionalities, such as **device-to-device interfacing**, **data communication**, **signal processing**, **displaying data**, **timing** and **control operations**, and almost every other functionalities that a system must provide

Networks

Communication infrastructures and components for sending and receiving information

Human to Machine Interaction

Refers to the **communication and interaction between a human and a machine** via a user interface

HCI (human-computer interaction) is the study of how **people interact** with **computers** and to what extent computers are or are not developed for successful interaction with human beings

Human to Machine Interface(2)

- Due to the multidisciplinary nature of HCI, people with different backgrounds contribute to its success.
- HCI is also sometimes termed human–machine interaction (HMI), man-machine interaction (MMI) or computer-human interaction (CHI).
- Humans interact with computers in many ways; the interface between humans and computers is crucial to facilitate this interaction.
- Desktop applications, internet browsers, handheld computers, and computer kiosks make use of the prevalent graphical user interfaces (GUI) of today.

Human to Machine Interface(4)

- Smooth communication between people and machines requires interfaces. The place where or action by which a user engages with the machine. Simple examples are light switches or the pedals and steering wheel in a car.
- However, a system can also be controlled by text being keyed in, a mouse, touch screens, voice or gestures.
- Voice user interfaces (VUI) are used for speech recognition and synthesizing systems.

How it works ?

- The devices are either controlled directly: Users touch the smartphone’s screen or issue a verbal command. Or the systems automatically identify what people want: Traffic lights change color on their own when a vehicle drives over the inductive loop in the road’s surface.
- Other technologies are not so much there to control devices, but rather to complement our sensory organs. One example of that is virtual reality glasses. There are also digital assistants:
  - Chatbots, for instance, reply automatically to requests from customers and keep on learning.

- Eliza, the first chatbot, was invented in the 1960s, but soon ran up against its limitations: It couldn’t answer follow-up questions.
- Today’s chatbots “work” in customer service and give written or spoken information on departure times or services.
- To do that, they respond to keywords, examine the user’s input and reply on the basis of preprogrammed rules and routines.
- Modern chatbots work with artificial intelligence. Digital assistants like Google Home and Google Assistant are also chatbots.

- They all learn from the requests and thus expand their repertoire on their own, without direct intervention by a human.
- The more chatbots understand and the better they respond, the closer we come to communication that resembles a conversation between two people. Big data also plays a role here:
- If more information is available to the bots, they can respond in a more specific way and give more appropriate replies.
- Gesture control and voice recognition also have share on this aspect.

Disciplines Contributing to HCI

Cognitive Psychology

Computer Science

Linguistics

Engineering and Design

Artificial Intelligence

Human factors

Future trends in Emerging Technology

5G technology

Enhance not just the mobile device experience but the entirety of the communications tech environment

Fast and high bandwidth communication

Enables driverless cars, remote surgery, iot, ...

Makes gaming or accessing social networks more exciting using wearable

Future trends in Emerging Technology

5G technology

Another promising application is no-touch computing, in which we can speak or direct our computers to perform without use of a mouse or keyboard

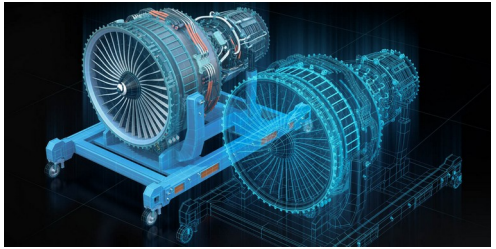
Future trends in Emerging Technology

Artificial Intelligence

Autonomous Devices

Blockchain

Augmented Analytics

Digital Twins

Immersive Experiences in Smart Spaces