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Big Data and Data Center

Cloud Computing and Cloud Services

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Big Data and Data Center

Data is keeping generated on Peta-scale …

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Data is keeping generated …

2002: Beginning of the Digital Age

2009: Big Data is the New Oil!

Big Data & Cloud Computing

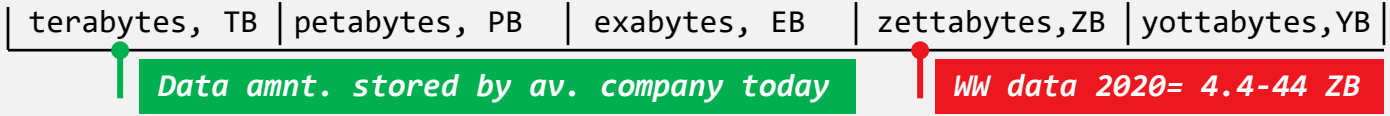
2015: Big Data Impact on SoC design

2016: Big Data-IoT

2017: Big Data-AI/ML

2018: Big Data-BCT

2019: Big Data-EC/IMC



Big Data Generation, Value and Cost

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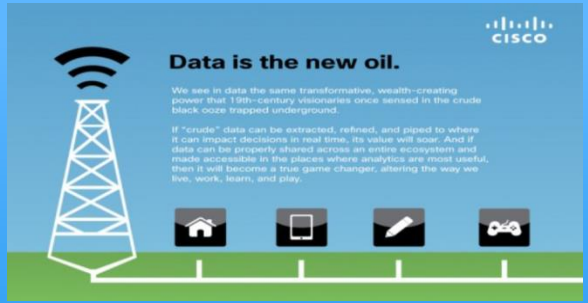
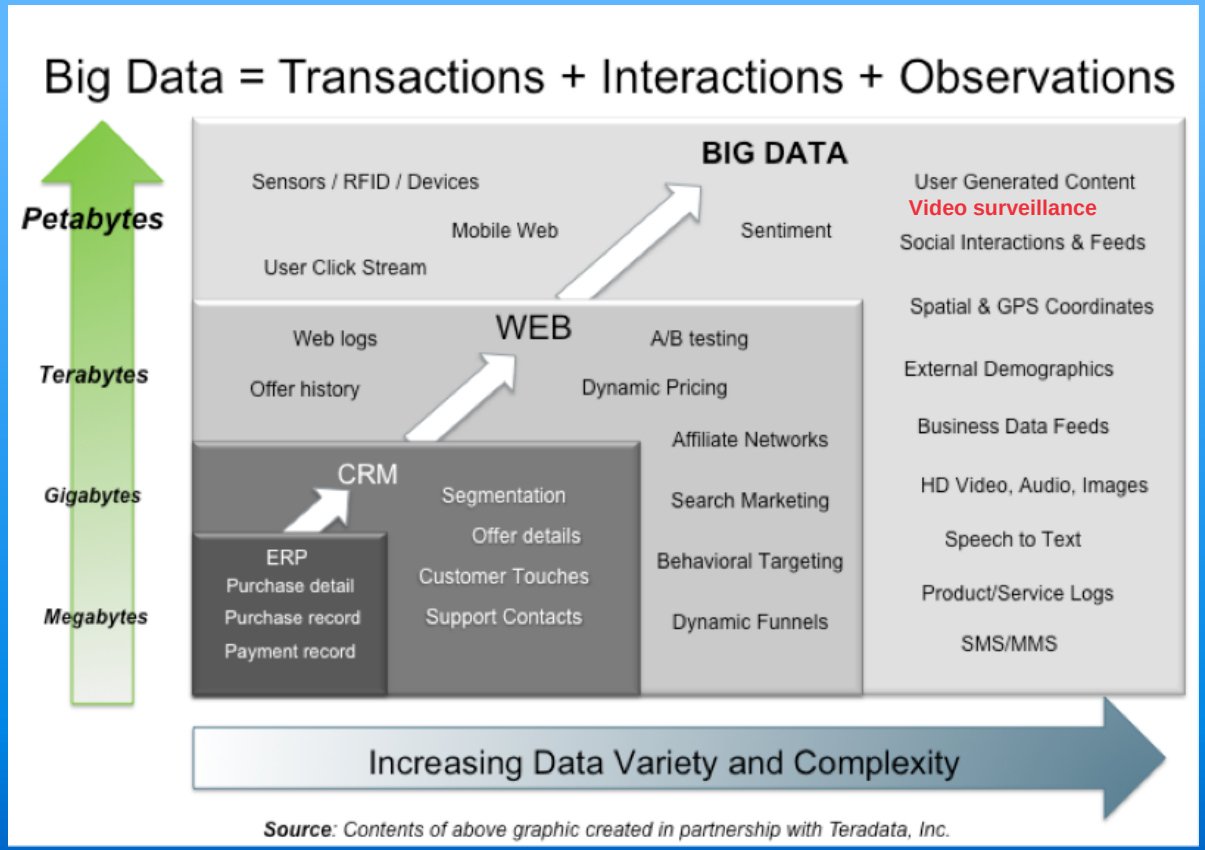
- Big Data is Generated Every Minute
  - Calls, Photo Posts,
  - Video Upload, Download Apps, …
- Data is Crude (2006) …
  - and Data is the New Oil (2012)
- Big Data Storage Cost
  - Cheap or costly?



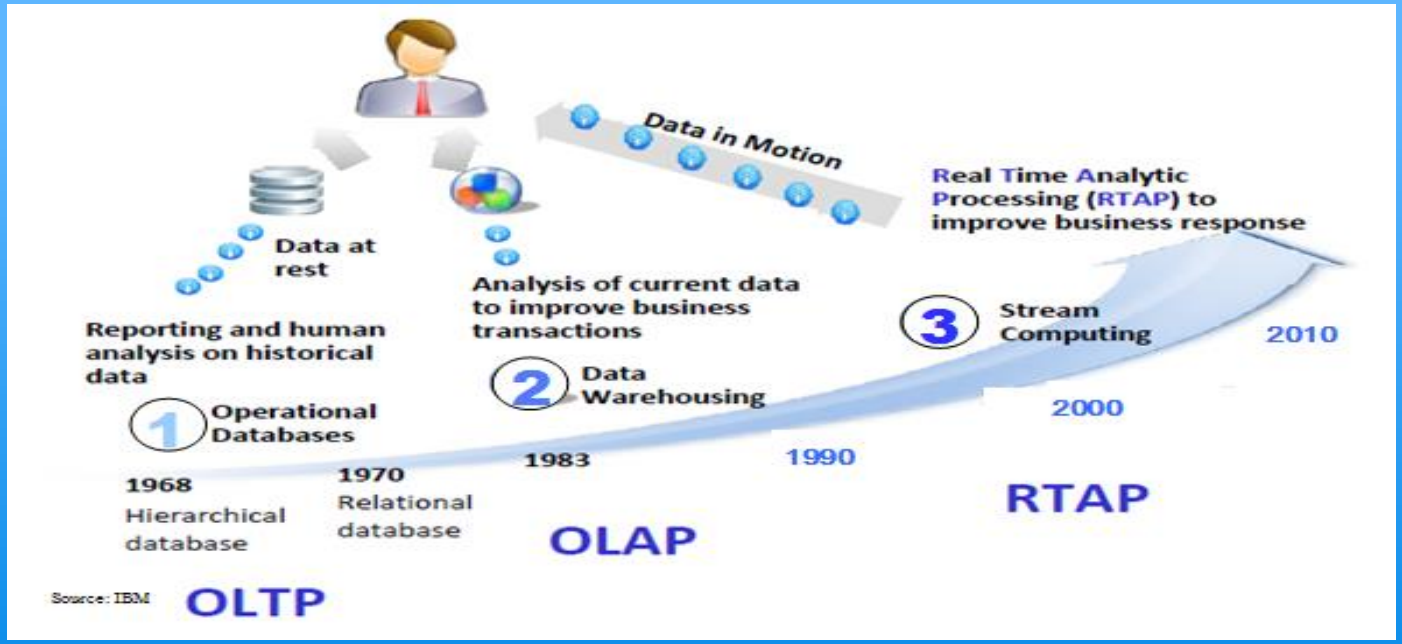
Characteristics of Big Data (3|5V's)

IBM 5V:

Volume, 大量
Variety, 多样
Velocity, 高速
Veracity, 真实性
Value, 价值



Harnessing Big Data



- **OLTP:** Online Transaction Processing (DBMSs)
- **OLAP:** Online Analytical Processing (Data Warehousing)
- **RTAP:** Real-Time Analytics Processing (Big Data Architecture & Technology)

Big Data and Data Center

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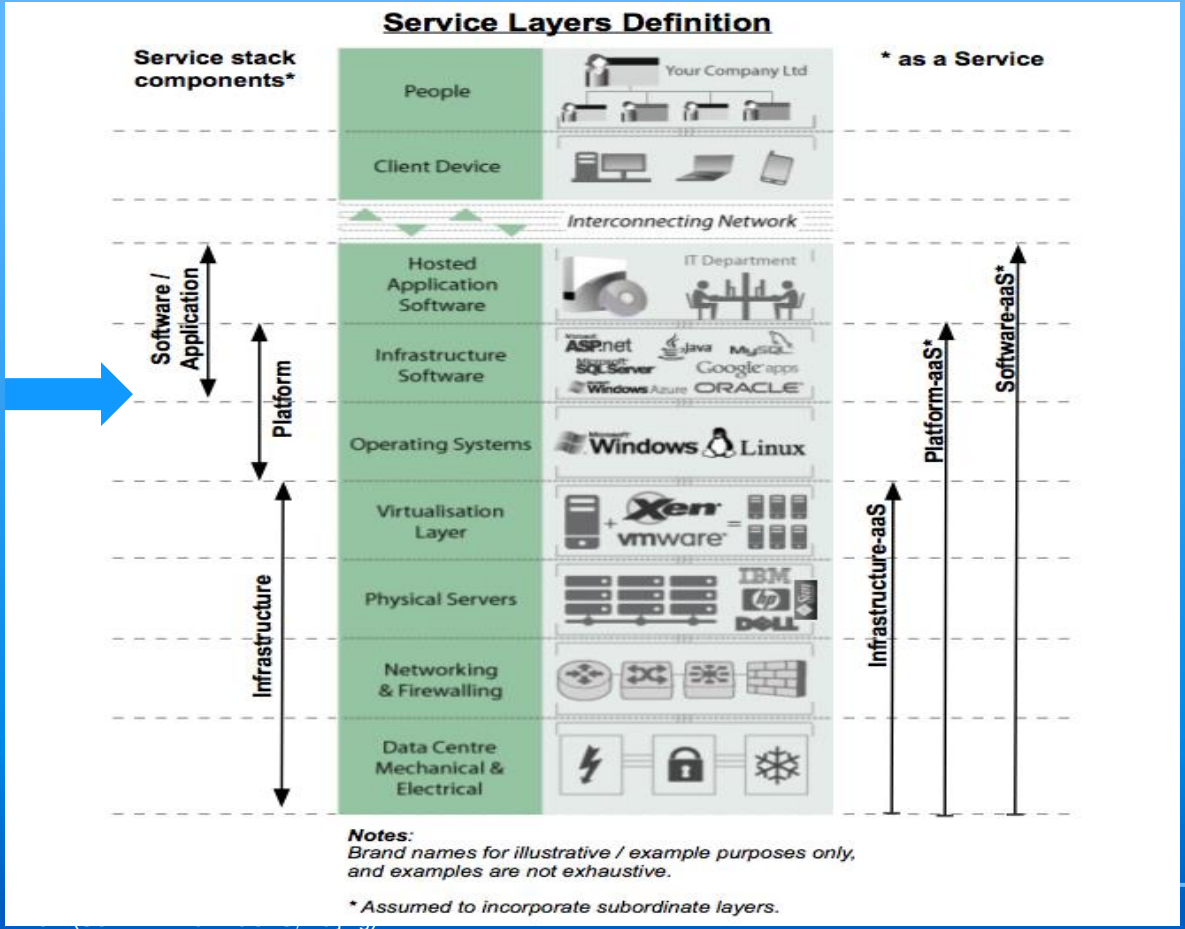
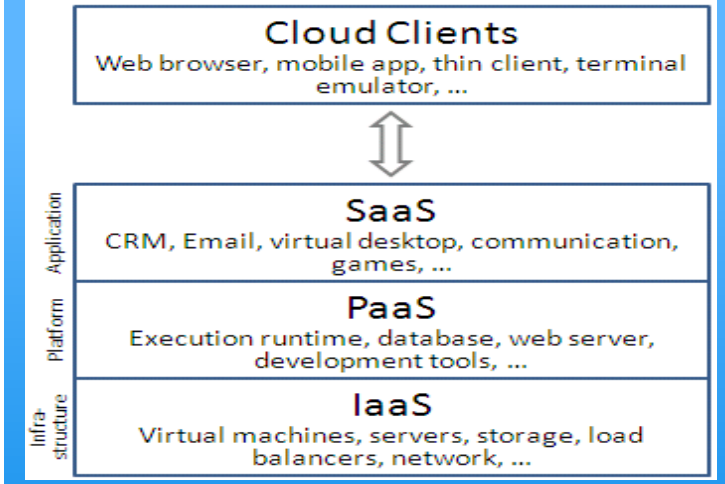
- Big Data and Data Analysis
- Cloud Computing and Edge Computing
- Data Center and Data Communication
- Data Storage and Memory Requirements
- Discussion

Service Layer Definition in Cloud





What are related to the IC chip design in the above?

Cloud Computing, Edge Computing, IoT

- Numerous emerging computing paradigms related to those areas of research and/or their intersections have come into play.
- These paradigms include
  - Mobile Cloud Computing (MCC), cloudlet computing,
  - mobile clouds, mobile IoT computing,
  - IoT cloud computing, fog computing,
  - Mobile Edge Computing (MEC), edge computing,
  - the Web of Things (WoT), the Semantic WoT (SWoT),
  - the Wisdom WoT (W2T), opportunistic sensing,
  - participatory sensing, mobile crowdsensing,
  - and mobile crowdsourcing.

Edge Computing by Wiki

- a distributed computing paradigm
- brings computer data storage closer to the needed location
- pushes applications, data and computing power (services) away from centralized points to locations closer to the user.
- **Cloud Computing** operates on “Big Data” while **Edge Computing** operates on “Instant Data” that is real-time data generated by sensors or users (ex. IoT data, VR glasses) .
- **Difference** between EC and CC: bi-directional communications between nodes (*ms*) versus minutes on cloud

Typical Technologies of Edge Computing

- Limitations of Centralized Cloud Computing for IoT
  - High latency
  - low spectral efficiency
  - non-adaptive machine type of communication
- **Edge Computing Technologies**
  - Mobile Edge Computing
  - Cloudlets
  - Fog Computing

Top Cloud Service Companies 2019

- Alibaba Cloud
- Amazon Web Service (AWS)
- Google Cloud Platform
  - Not as popular as AWS or Microsoft Azure
- IBM Cloud
- Microsoft Azure
- Oracle Cloud

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Teradata Corporation (1979- , Ohio)

NYSE: TDC (500 S&P Component)

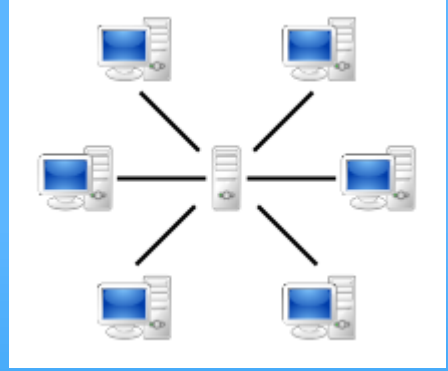
- 1976-1979: Concept of Teradata at Caltech on Citibank
- 1983: First beta system shipped to Wells Fargo Bank
- 1984: Teradata releases the world's first **parallel** **data warehouse** and data marts
- 1986: Fortune mag. names Teradata "Product of the Year"
- 1992: the first system over 1 terabyte, → Wal-Mart
- 1996: the world's largest db at 11 TB; 1997 24TB; 1999 130 TB;
- 2003: >120 companies Oracle → Teradata; Teradata Univ. created, incl. 170 univ. in the network; 2007 850 univ.
- 2008: innovative use of SSD
- 2013: …

Top 10 Data Center and Storage

Datamation

- 2017 Equinix, 9.5% share, Redwood City
  - Rev. $3.6B, 150+ DCs, 21 Countries WW, 2900+ Partners/Providers
- Digital Realty Trust, 5.7%, San Fran.
  - Rev. $2.1B, 156 DCs
- China Telecomm, 3.3%, Beijing, Rev. $352B, 400+ DCs
- CenturyLink/Cyxtera Technologies, 2.1%, Monroe, La.
- China Unicom, 2.1%, Beijing
- Verizon, 1.9% NYC
- DuPont Fabros Technology (DFT), 1.9%, Wa. DC

Data Center Hardware



- Core computing equipment:
  - **Desktops, Servers, Server racks**
- Network equipment: Routers, Switches, Modems, Firewalls, Cables
- Storage resources: Hard drives, Tape drives, Backup storage
- Power and cooling: Power generators, Cooling towers, UPS
- Other I/O devices: Printers, Keyboards, Mice (Mouses), Scanners

Memory Makers and the Patents

- SRAM
  - Cypress, Honeywell, IDT, Micron, Mitsubishi, NEC
- DRAM
  - Conversant, Qualcomm, Rambus, Round Rock Research
- NAND Flash/ NOR Flash
  - Micron, Microsemi, STMicro/ Micron, Microsemi, Samsung
- Wuhan XinChip (2006-) 12” DRAM & NAND Factory (started 3/28/16)
- Storage Patents:
  - 25% Paby Micron, Samsung Electronics, Toshiba, IBM & Intel

BitCoin Chip and AI Chip

- BitMain Chips
  - Jan 2018 AI chip for CNN/RNN/DNN, BM1680,
    - supports FP32, peak 2TFlops, peak 41W, avg 25W
  - Sep 2018 AI chip for face recog., faceID, BM1684
    - 6TFlops, 30W on TSMC 12nm
- Canaan-Creative Chips
  - 12/17/2017, Edge Computing KPU for ADAS, Voice, Smart IoT

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Example: EHT Data and ML-CHIRP

- Event Horizon Telescopes (EHT) Data
- Katie Bouman, 6 years at MIT, 0.5 ton data on tapes

Memory/Storage and CPU

- 1970, Intel's early product success on ***DRAM*** *1103*,
- 1980, memory market: Japanese co. 30%, US >60%
  - 1985 Jap. > US; Intel: Memory → CPU [x86 CISC]
- 1990, 5 key RISC players: SUN, SGI, IBM, DEC, HP
- 2000, **SoC integration** w/ ROM/RAM [Flash: NOR, NAND]
- 2010, Moore's Law and EUV [DDRx/LPDDRx]
- 2016, Samsung is the only **3D NAND** (3rd gen.) producer
  - XMC to invest $24B 2016, to produce 200k 12"-wafer/mon.
- *2020, Data transportation/switching at high data-rate…*

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International Conferences on BD

- IEEE BIG DATA SERVICE 2019 (5th; Since 2015-)
- **ICCBDC 2019 (3rd International Conference on Cloud and Big Data Computing; 2017-)**
- icABCD 2019 (International Conference on Advances in Big Data, Computing and Data Communication Systems; 2018-)
- ICBICC 2019 (International Conference on Big data, IoT, and Cloud Computing)

Cloud Standards Customer Council

Security for Cloud Computing

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Cloud Standards Customer Council

WHAT'S NEW

Security for Cloud Computing

The whitepaper includes a list of steps, along with guidance and strategies, designed to help decision makers evaluate and compare security offerings from different cloud providers.

Learn More

Summary

- Generation of Big Data
  - Teradata, Peta-scale, Exa, Zetta …; 3V
- Analysis and Application of Big Data
  - OLTP, OLAP, RTAP/RTDP
- Data Center and Cloud Service
  - Data Storage; IaaS, PaaS, SaaS
- Blockchain Technology
  - Hash Function, Merkel Tree,
  - 5G/IoT and BCT; Security is a MUST!