Media Lab
KyungHee University

ViVa CC

Video Value-adding Cloud Computing

Computed out of Captured

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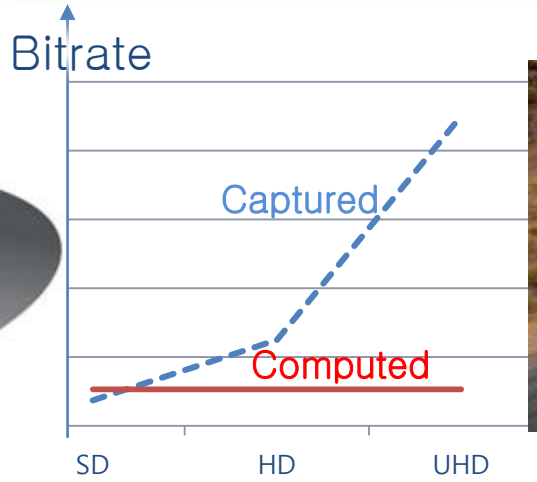
Scope of MPEG



Computed video

- No MPEG codec
- No original to compare with
  ➔ MOS

Captured video

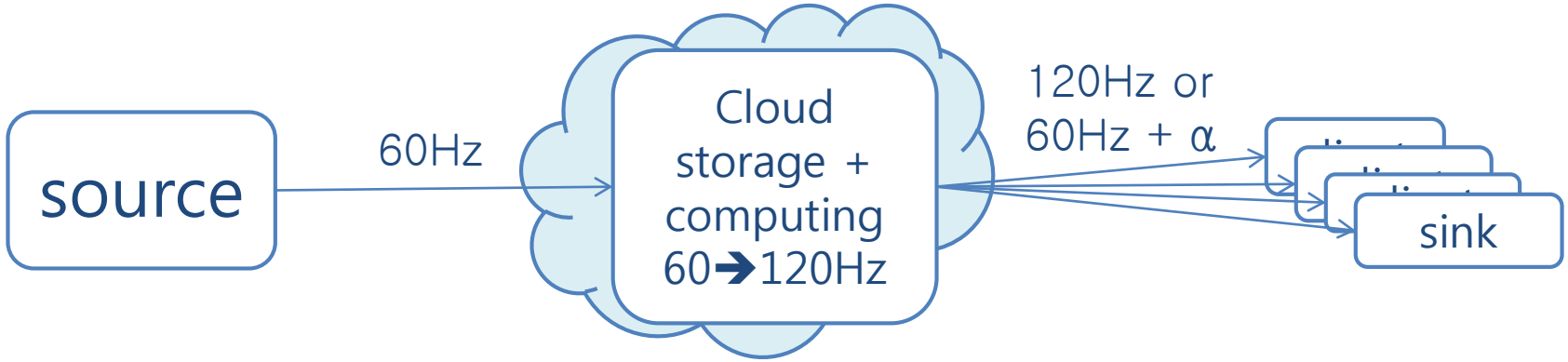
- MPEG codec exists.
- Compared to the original
  ➔ PSNR

- How about something in middle?
  - "computed video out of captured video"
  - Scope of MPEG video?

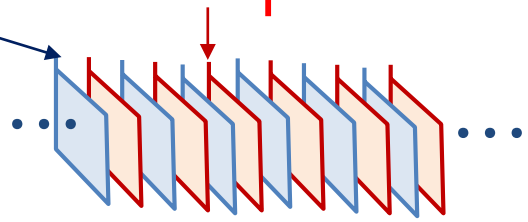
Up-scaling in video

- Value-addition in clients

- Value-addition in cloud ➔ thinner clients

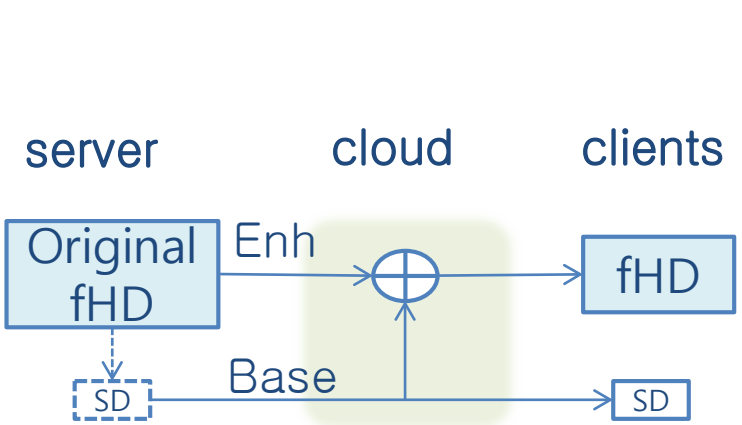


- Mixture of 'captured' and 'computed'
  - The same codec?
    - ➢ Couple FRUC and compression?

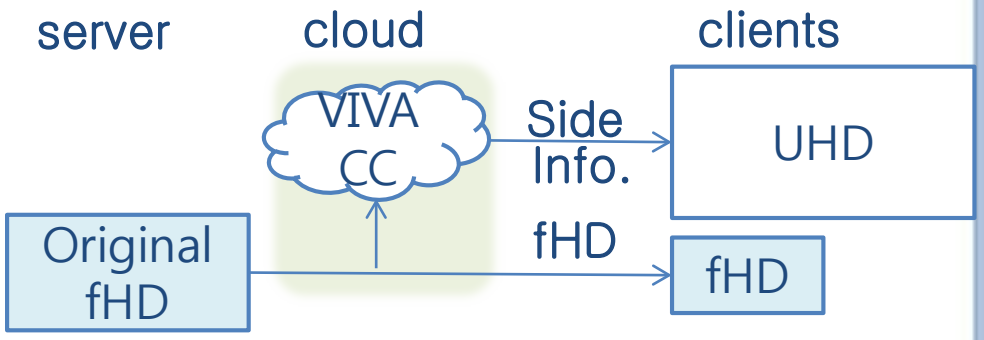


U-SVC

- U-SVC(**U**p-**S**calable **V**ideo **C**oding)
  - SVC(worse than original) vs. U-SVC(better than original)
- U-SVC for **computed captured** video
  - Bitrate: **R**(UHD) >> **R**(fHD +Side Info.)
  - Complexity: **C**(UHD) >> **C**(fHD +Side Info.)

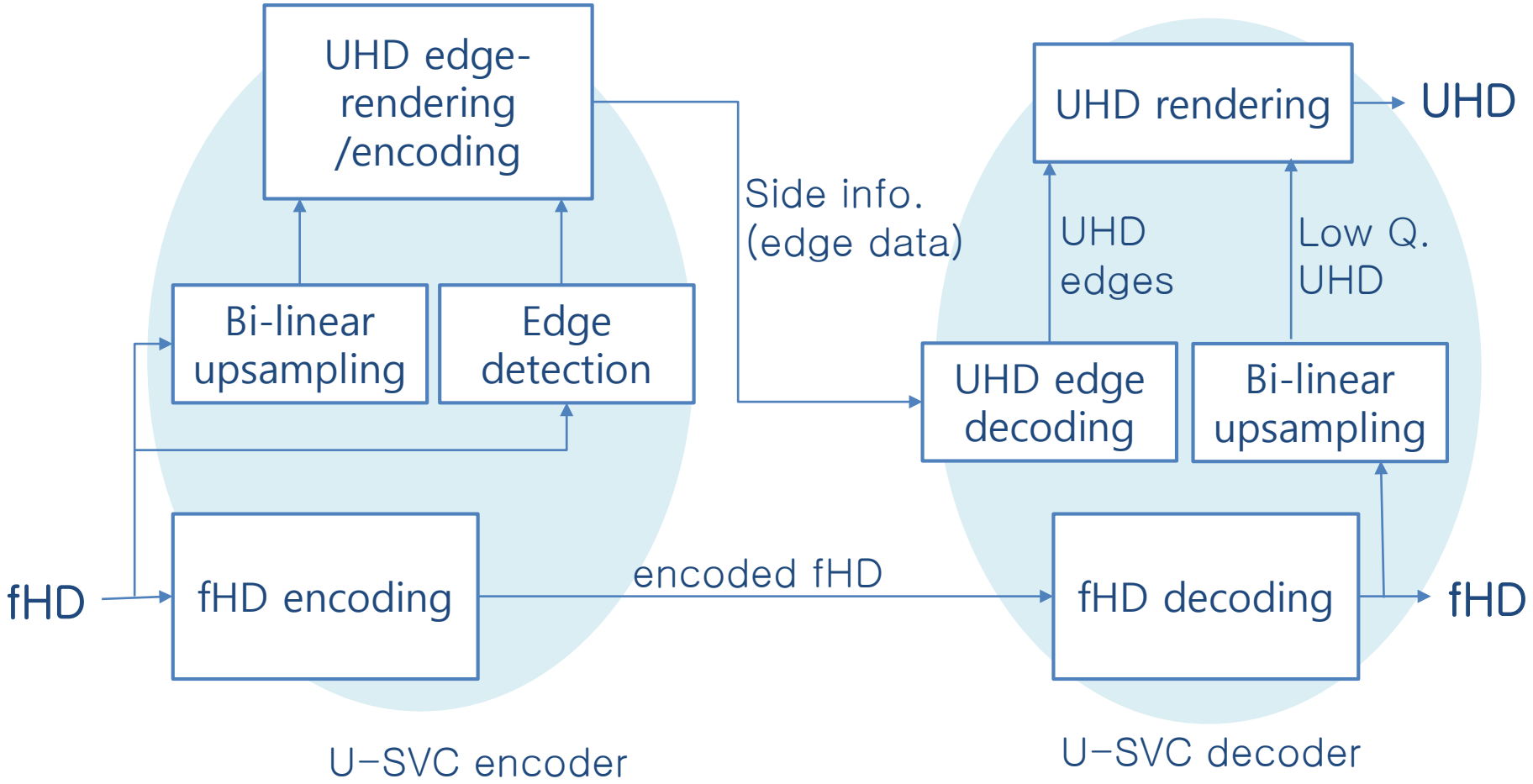


Legacy SVC



Proposed U-SVC
(up-scalable video coding)

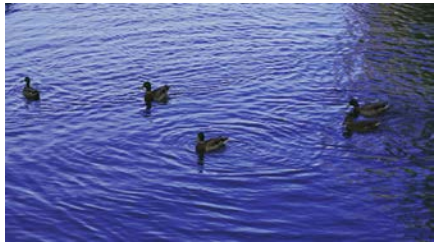
Tentative U-SVC algorithm



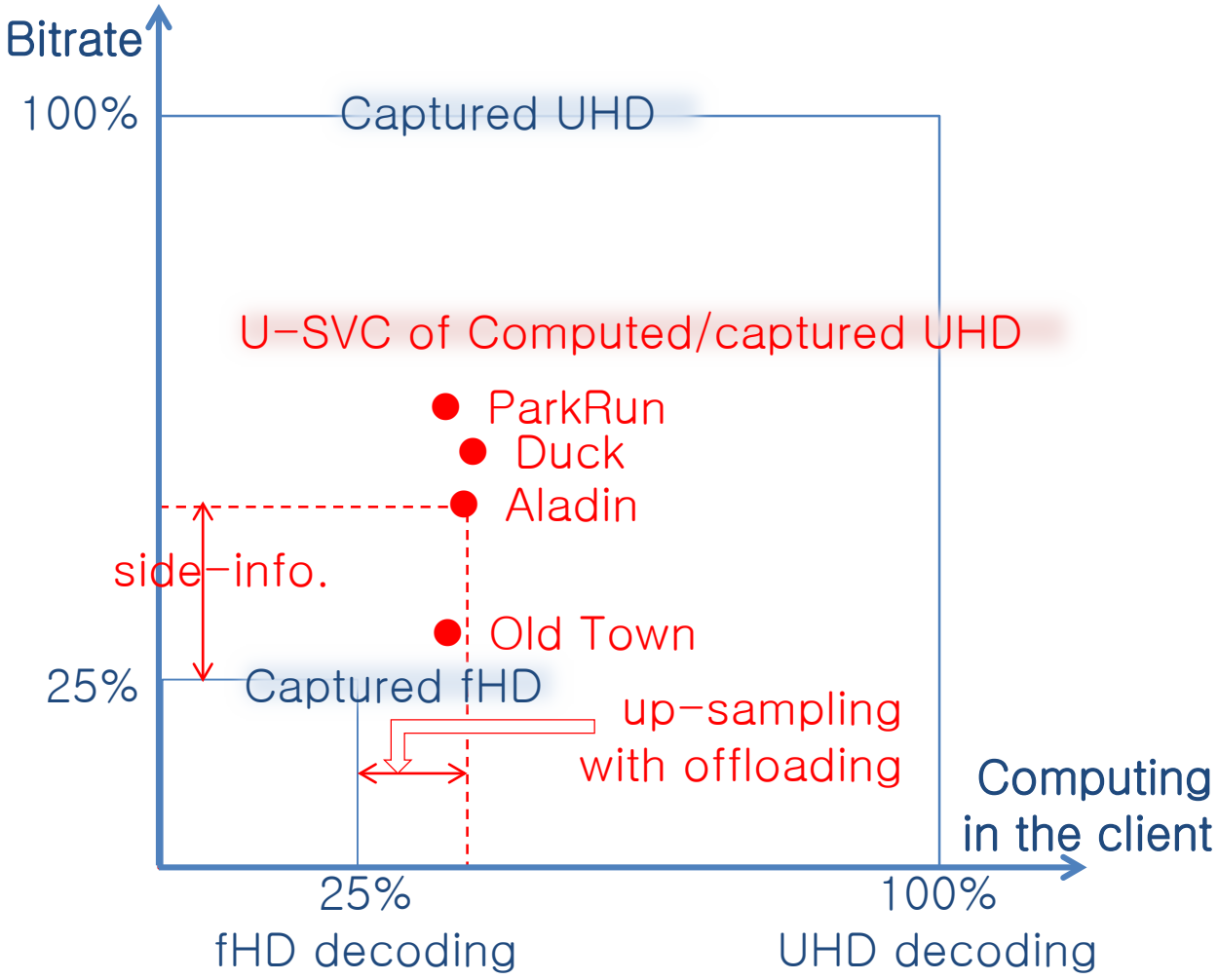
Tentative results(1)

- Goal: video that looks like UHD
  - Evaluated by MOS, but not PSNR

	Aladin	Duck	Old Town	Park Run
Computed	4.3	4	3.9	3.7
Original	4.5	3.9	4.1	3.9

Tentative results(2)



Usages

- Thin source, thick sink

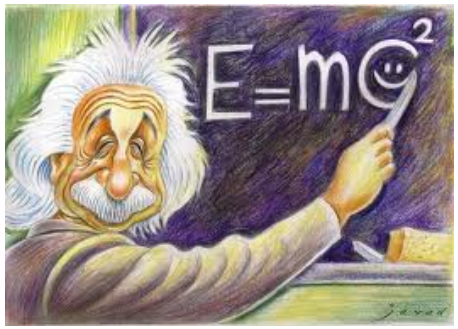
U-SVC

- Old contents ➔ new device

U-SVC

Value-Computing Equivalence

- Relativity theory



(energy) ←→ (mass)

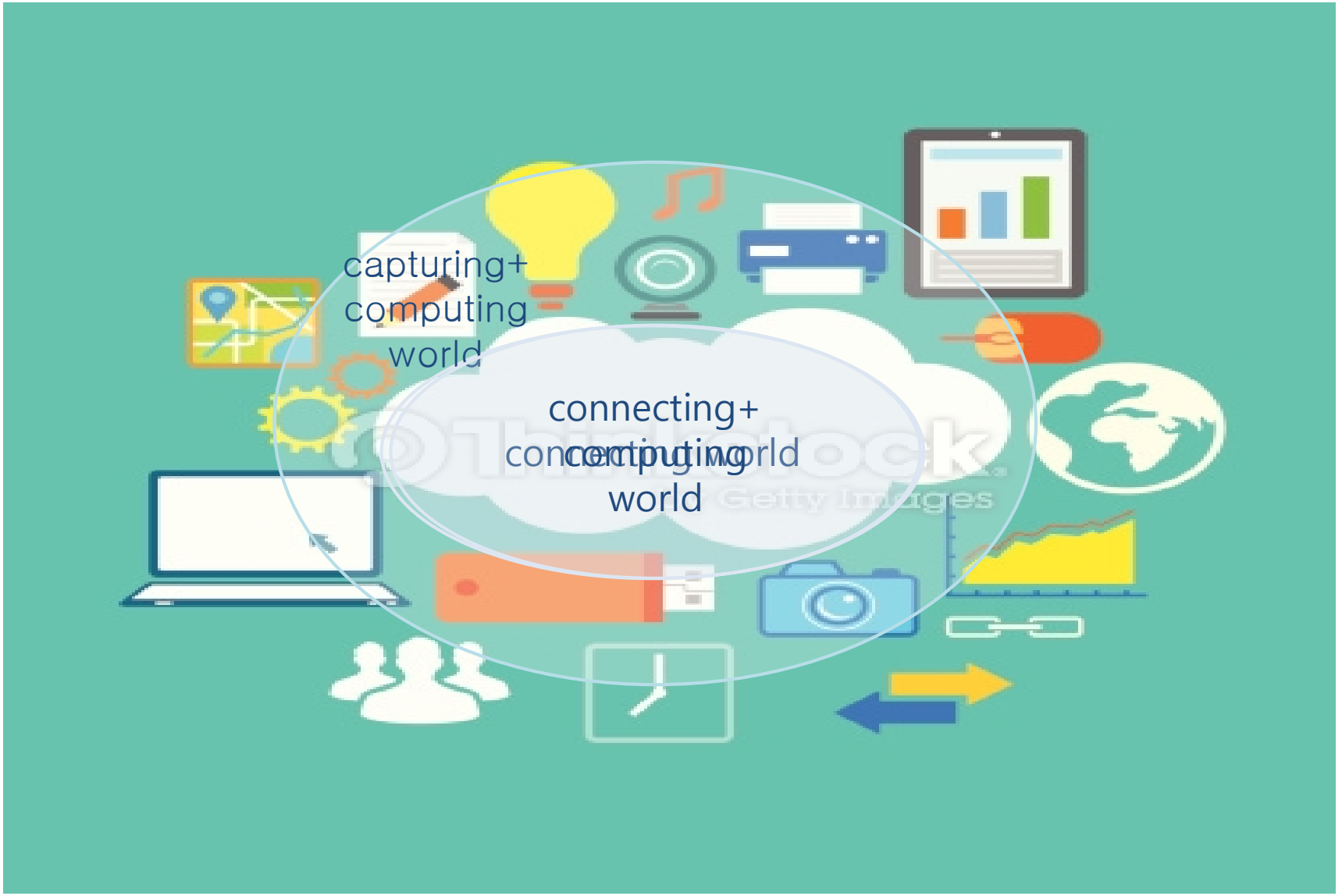
$$E = mc^2$$

- Viva CC (value) ←→ (computing)

$$V = CN^2$$

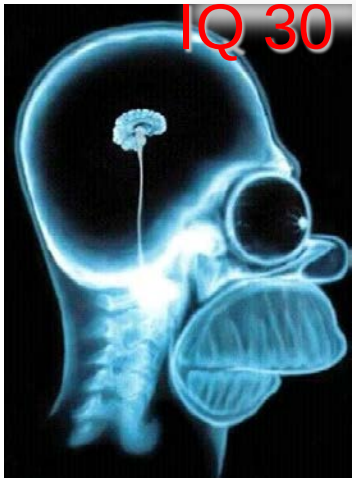
V: Value
C: Computing
N: Nodes in network

Computing in network



Network ➔ Networking

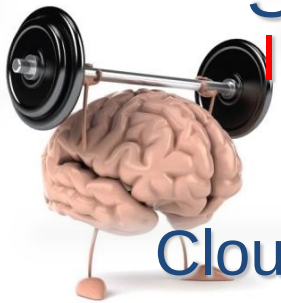
- Smarter networking, what's good to MPEG?



"You think me stupid?"

CDN
IQ 80

SDN
IQ 100



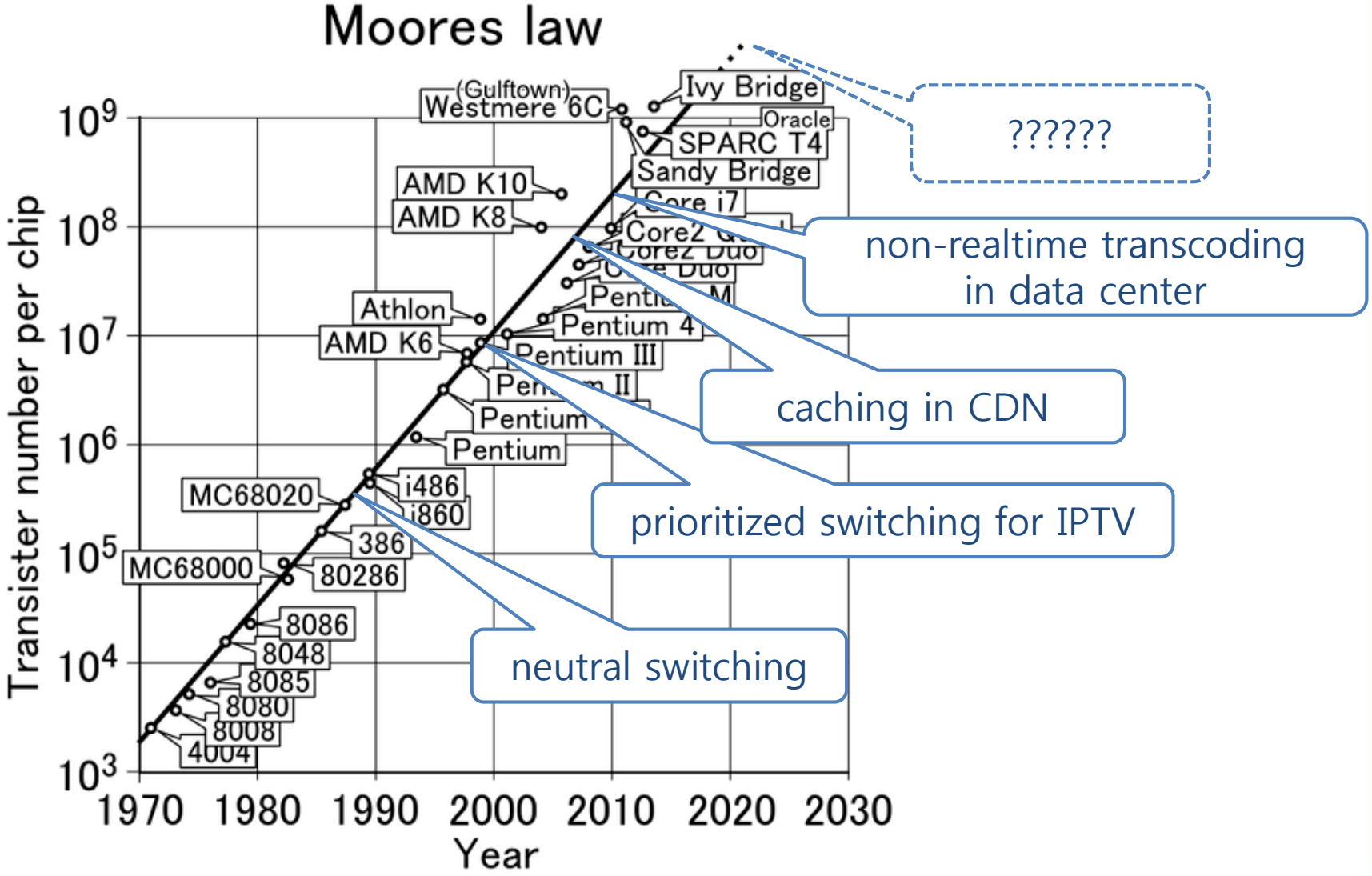
Cloud computing
IQ 150

"Exploit my power!"

- ViVa-CC (**Vi**deo **V**alue **a**dding **C**loud **C**omputing)
  - Cloud apps just as smart phone apps

Moore's Law and networking

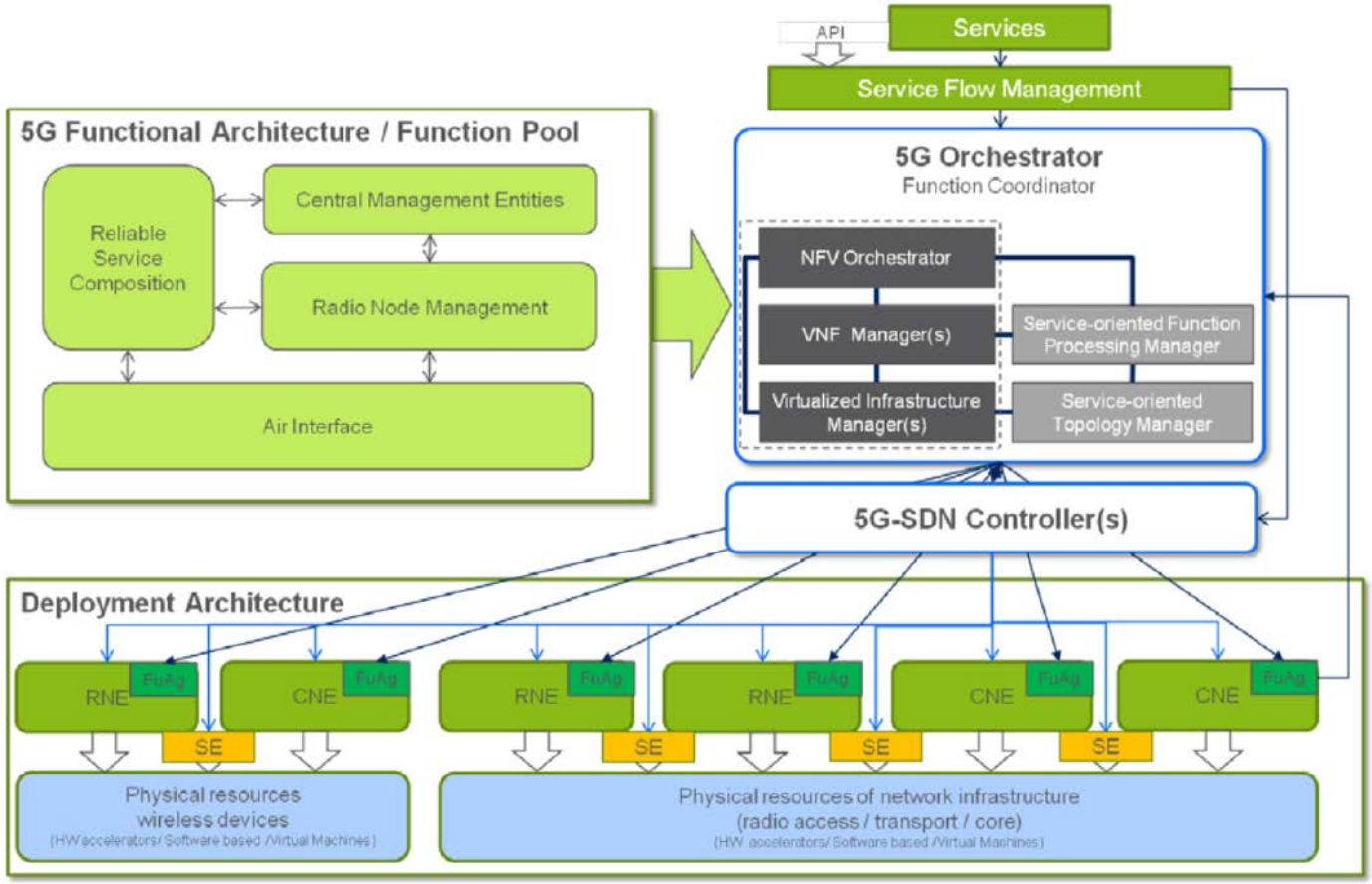
- More sophisticated network process for video?



Hyper-giants with computing power

- (service + network) >> (network + service)
  - ➢Abundant computation resources
  - ➢Value-Adding by computing
    - Ex) Youtube: transcoding, camera stabilization, etc.
  - ➢Google, Amazon, Ebay, Netflix, etc.
- Proprietary, yet. ➔ MPEG standard?

METIS 5G Model



- VNF(Virtual Network Function) for multimedia
  - Waiting for input from media people
  - APIs or apps in cloud (just as smart-phone apps)

ViVA = Implementation issue?

gemstone

ViVA-CC

Diamond

ViVA-CC in audio

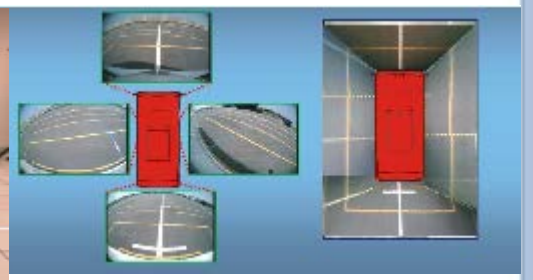
- New LP album of the late singer Jaeha Yoo
  - Gloomy voice to cheerful young voice
  - More powerful drum sound
  - More accurate guitar melody
  - Enriching volume of bass
  - Different xylophone sound

- 4kHz speech ➔ 7kHz
  - Artificial high tones for more realistic sounds
    - ➢ 'p', 'k', 't', 'h', 'f' voiceless sounds.
  - **The same 7kHz codec??**

ViVA-CC CV

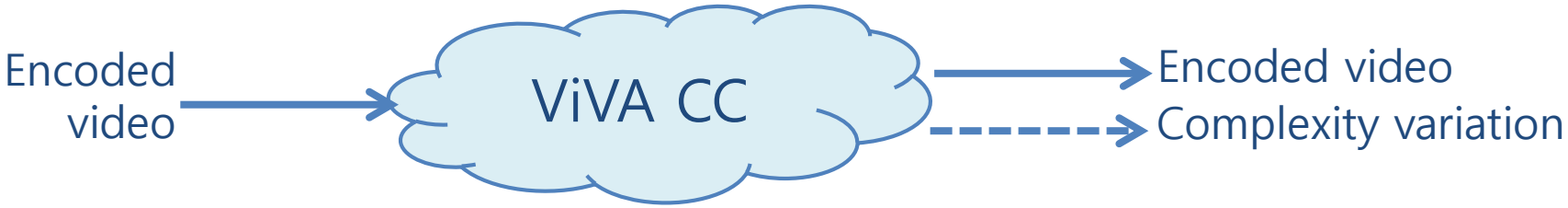
- Collaborative video
  - Collaborative spectators
  - Squad battle
  - Teleconferencing
  - Around view in car

VIVA

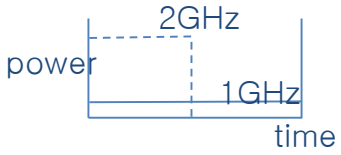


Green ViVA-CC

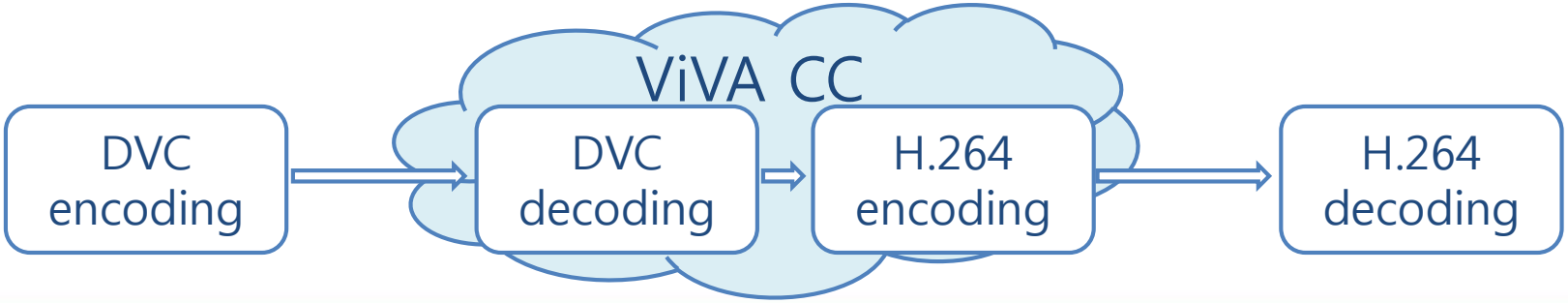
- Green client(←Green MPEG)
  - Energy α CPU frequency(complexity prediction).
  - Display energy and back-light brightness distribution.



$E \alpha TC^2$



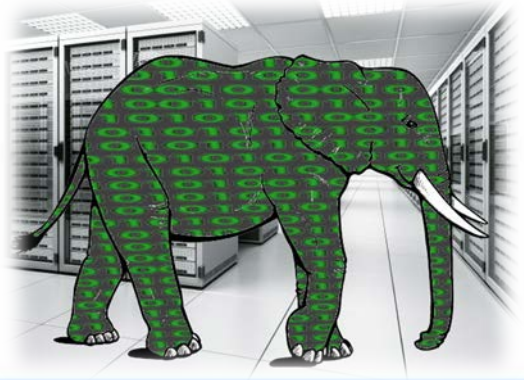
- Green encoding(distributed video coding)
  - DVC encode : decode ~ H.264 decode : encode = 1:15



Wise ViVA-CC

- Context extraction for video
  - Pattern recognition and classification

- Usages
  - Intelligent naming for CCN (annotation)
  - Intelligent search (e.g. feeling) (← MPEG-7)
  - Big data



ViVA-CC Standardization

- MPEG-ViVA Part 1 ViVA-system➔ MPEG MIoT
  - ViVA-CC commands(APIs)
  - ViVA-CC file format, FEC, security etc.
- MPEG-ViVA Part 2 ViVA-video
  - New codec on computed/captured video
  - Collaborative video
- MPEG-ViVA Part 3 ViVA-audio
  - AuVA(AUdio Value Addition), collaborative audio
- 3GPP SA24 (joint of SA2 and SA4)
  - Smart Base Station

- ??? Do we need standards at all???

Value chain of ViVA-CC

- Co-prosperity of stakeholders
  - Any party could plant **App** in cloud