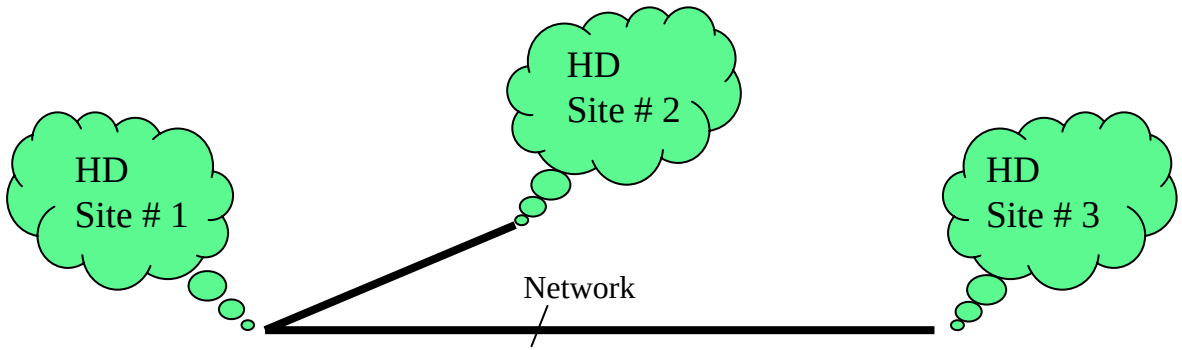
Morphic Computational Architectures: 2D and 3D Video Conferencing Challenges

Thanh Tran, Ph.D.
Video Conferencing Engineering Manager
Texas Instruments Incorporated

Outline

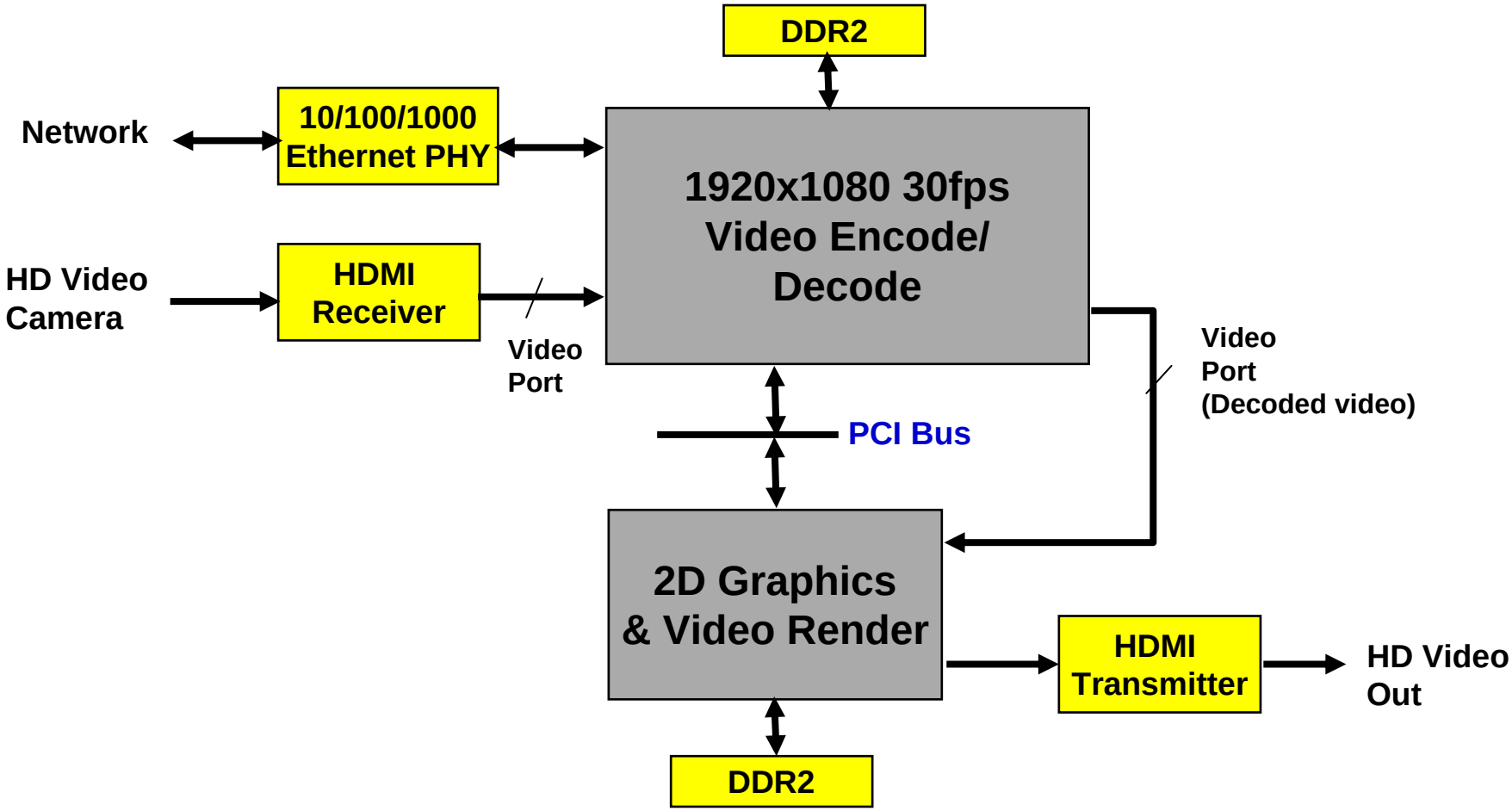
- *HD Video Conferencing Overview*
- *2D and 3D HD Video conferencing Systems and Challenges*
- *Power Per HD Channel*
- *Call For Research*

HD Video Conferencing Overview

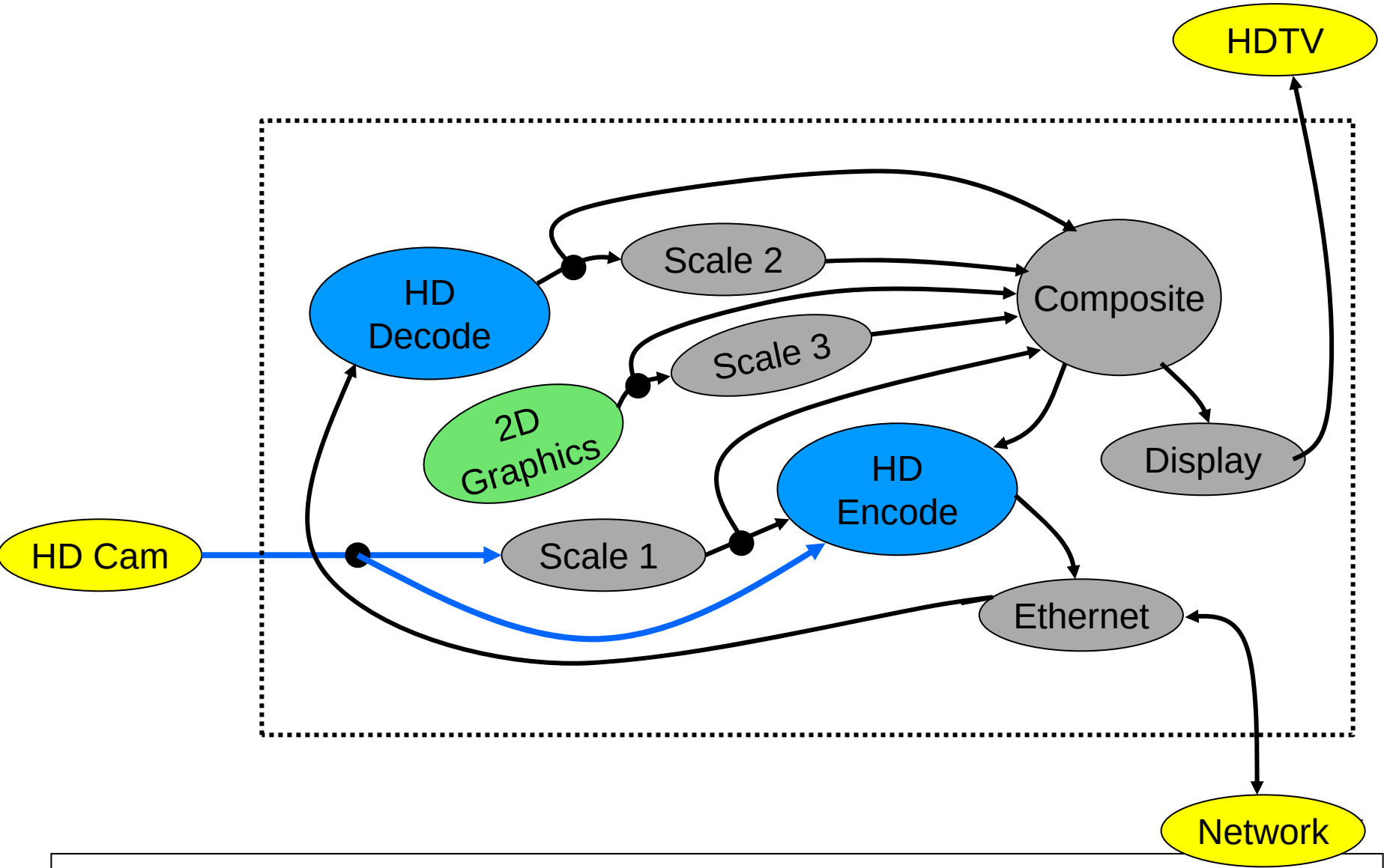


- Simultaneous full frame rate HD video compression and decompression, 1920x1080 30fps.
- Low latency video transmission between sites, less than 250mS including network latency.
- Supporting multiple video formats, H.264, H.263, H.261, H.241, etc..
- Scalable system design to process multiple CIF (352x240) channels and or HD (1920x1080) channels.
- Maintaining good video quality under severe network congestion

Typical 2D HD Video Conferencing Architecture



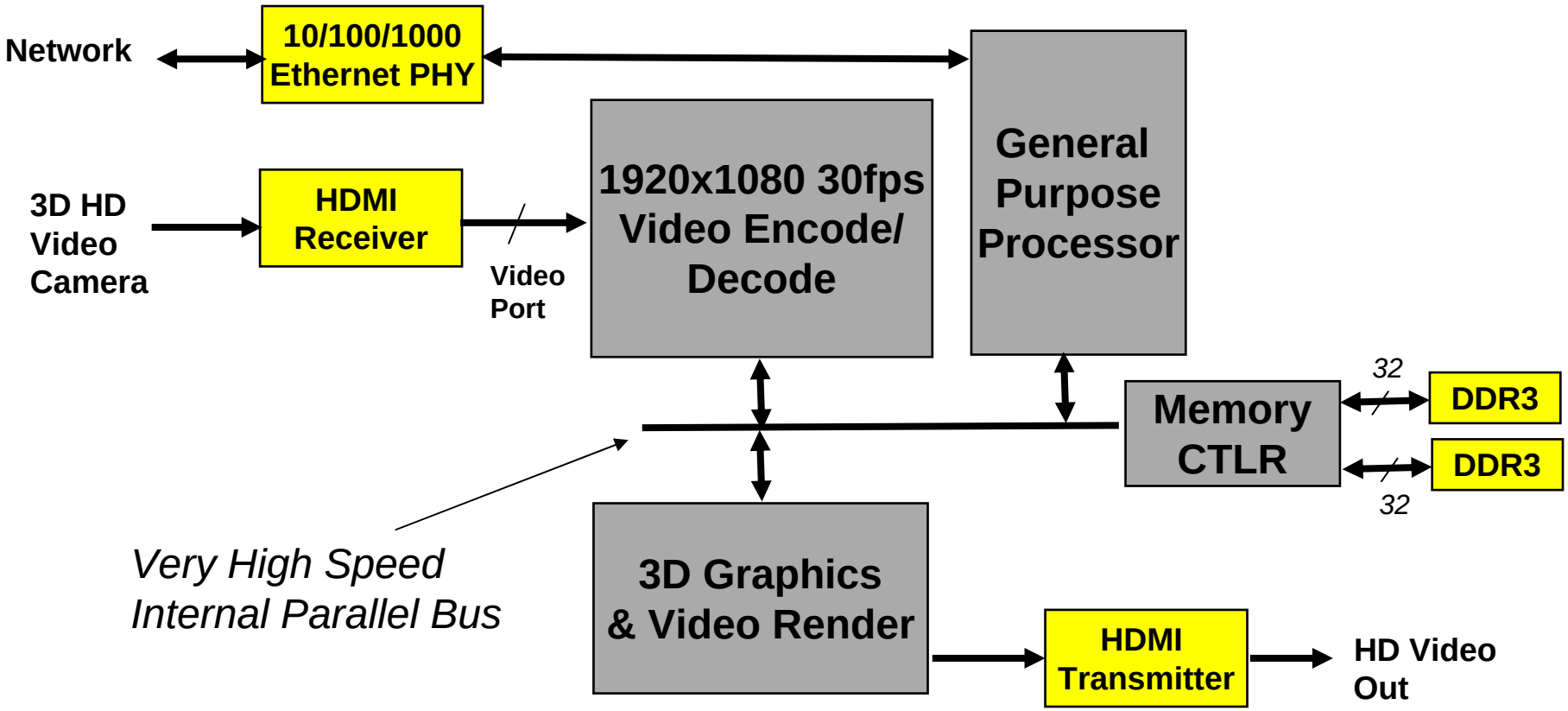
Typical 2D HD Video Conferencing Dataflow



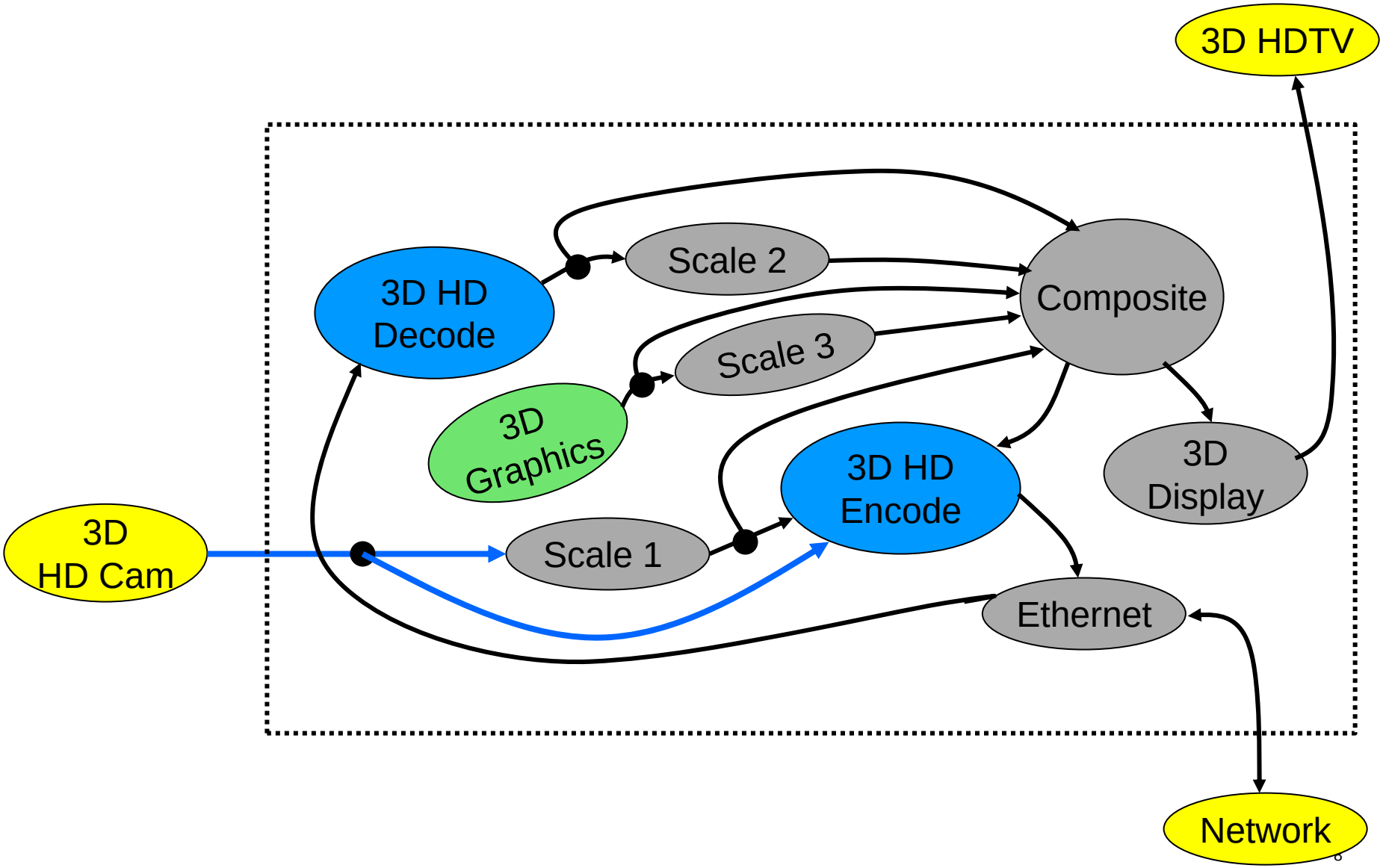
Challenges in 2D HD Video Conferencing

- ***Smart camera or camera array auto-detects and focuses on the person speaking. "Eye contact" is very difficult.***
- ***Wireless connection between the camera and the conferencing system***
- ***Very low latency system design, from capture locally to display remotely***
- ***Low bitrate video compression algorithms***
- ***Better network routing algorithms to avoid congestions***
- ***Low power per HD encode and decode channel. Currently, less than 1 watt per HD (1280x720p30) encode channel is possible.***

Typical 3D HD Video Conferencing Architecture



Typical 3D HD Video Conferencing Dataflow

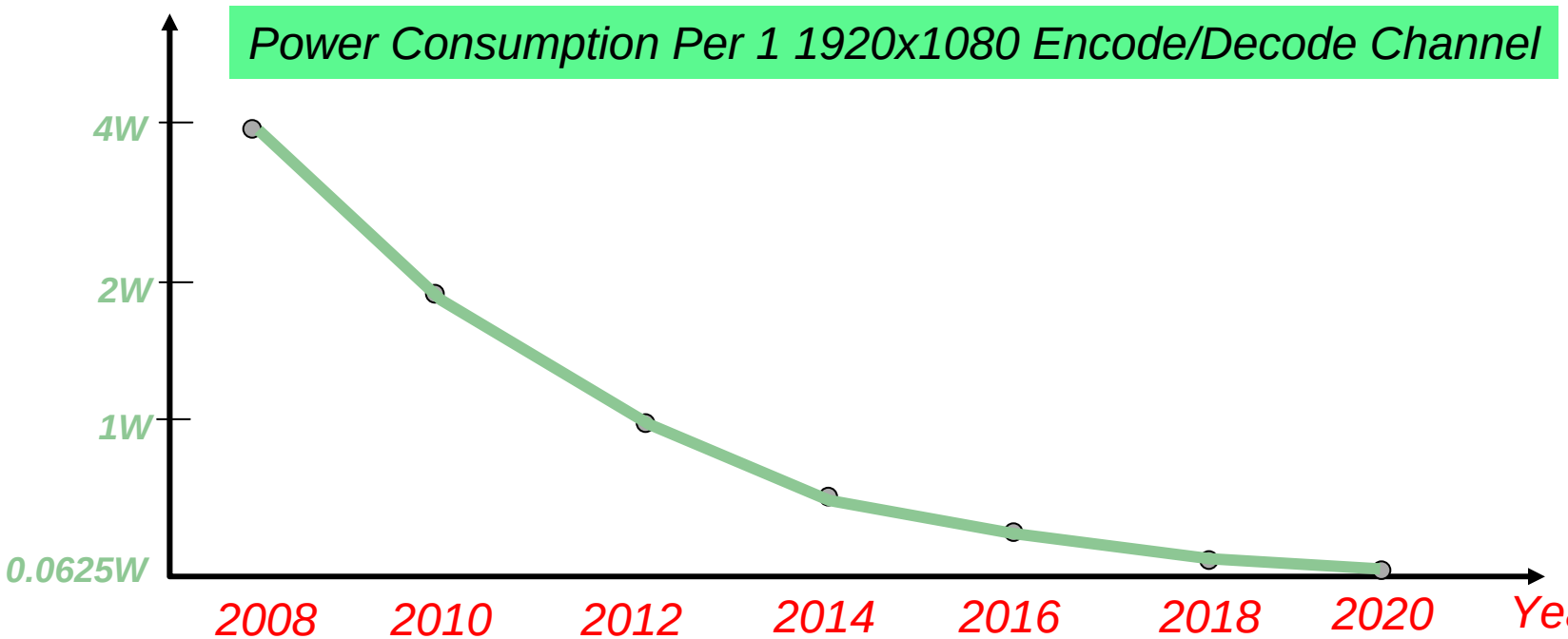


Challenges in 3D HD Video Conferencing

- *"Holographic" video conferencing demonstrated by Cisco*
- *Smart 3D camera or camera array auto-detects and focuses on the person speaking*
- *Wireless connection between the 3D camera and the conferencing system*
- *Very low latency system design, from capture locally to display remotely*
- *Low bitrate video compression algorithms*
- *Better network routing algorithms to avoid congestions*
- *Multi-view video conferencing*
- *Multi-view video display*
- *Much less than 1 watt per HD channel*

Power Per HD Channel

- ***Now: 4 watts per one 1920x1080 30fps H.264 simultaneous encode and decode channel.***
- ***2 Years from Now: 2 watts per one 1920x1080 30fps H.264 simultaneous encode and decode channel.***
- ***Video encode and decode power consumption reduces about 50% in every two years.***



Call For Research

- ***Low cost 3D video camera***
- ***3D video compression algorithms, Multi-View Coding***
- ***Low cost 3D video display***
- ***Achieve a 62mW per HD encode/decode channel in 2020***
- ***External memory interface has been a bottle-neck for many years now. Higher throughput serial memory port is necessary.***
- ***Reconfigurable hardware accelerators to process video, graphics and control data efficiently.***
- ***Higher density HD video encode/decode channels per SoC. Double the video channel density in every two years. Achieve a 64 1920x1080 30fps channels encode/decode in one SoC in 2020. Moore's Law is well and alive again!***