

**Project: IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)**

**Submission Title:** [Visible Light Communications Standard Issues]

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**Source:** [Tae-Gyu Kang, Tae-Wan Kim, Chung Myung-Ae] Company [ETRI]

Address []

Voice:[], FAX: [], E-Mail:[tgkang@etri.re.kr]

**Re:** [vlc\_ig]

**Abstract:** [This document describes standard issues for VLC]

**Purpose:** []

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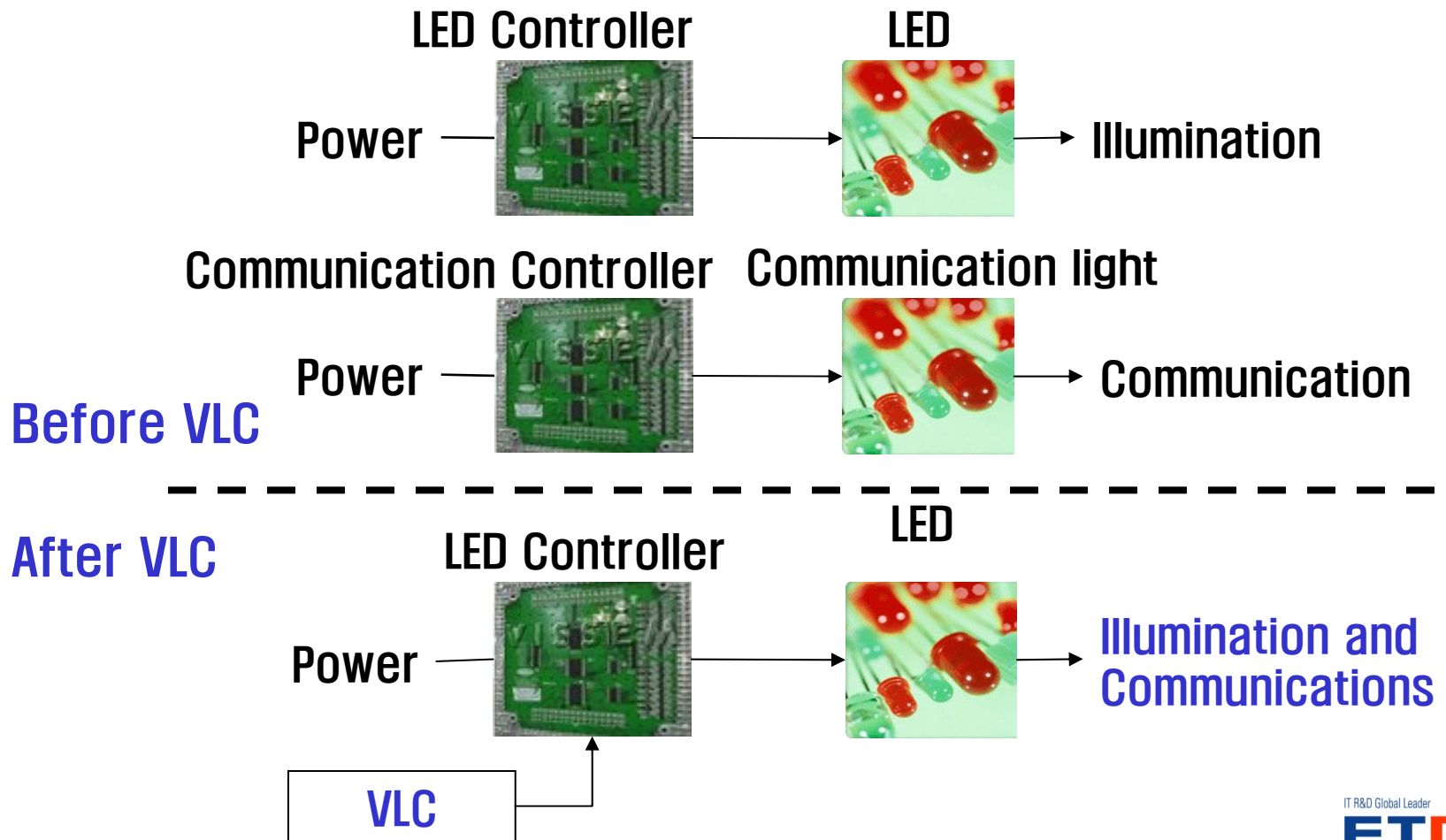
# Visible Light Communications Standard Issues

Tae-Gyu Kang  
tgkang@etri.re.kr  
ETRI

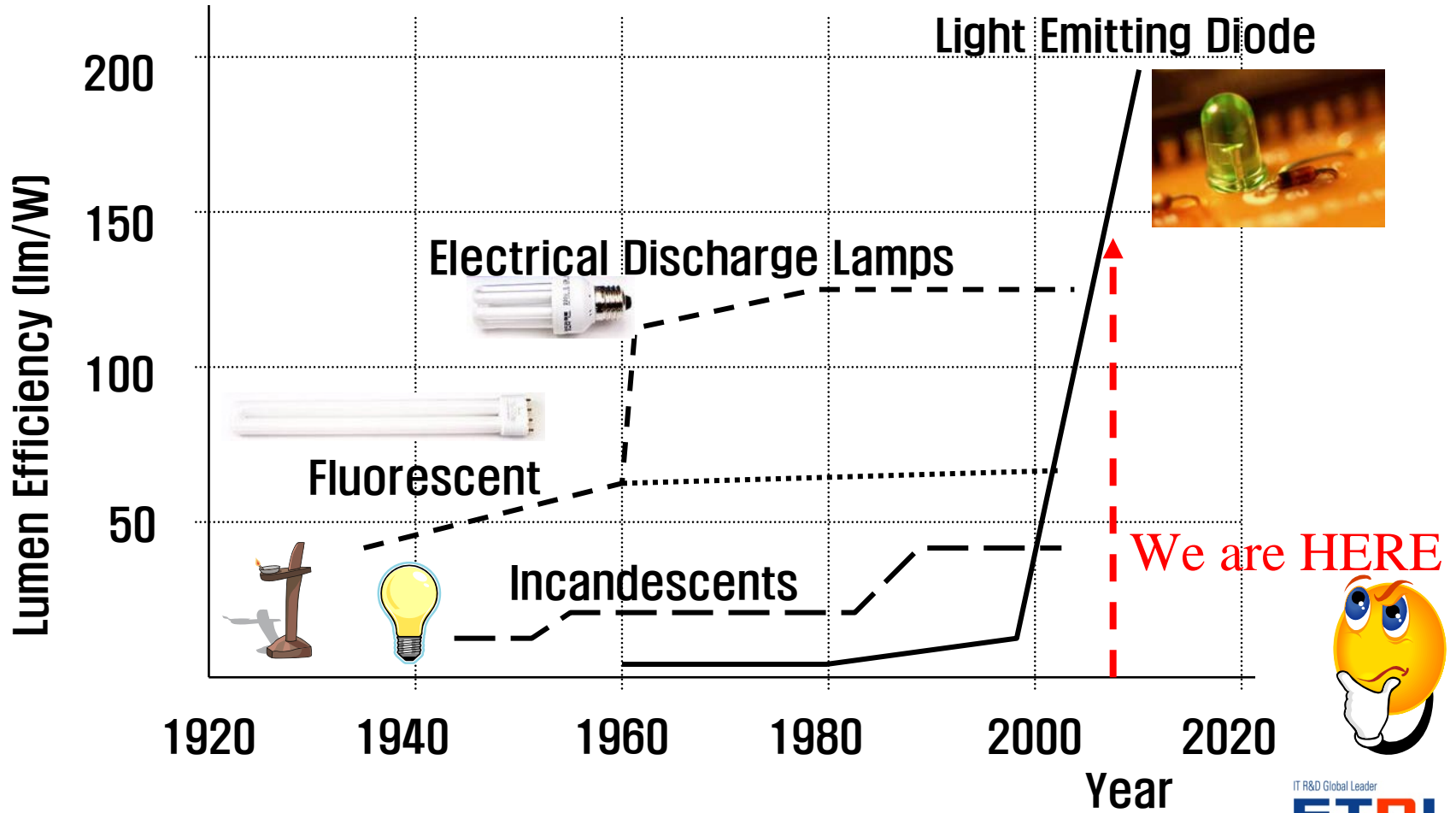
# Why VLC using LED

- One Lighting Source
  - Illumination and communication
  - No extra special lighting for transmitter
- Fast Deployment
  - Traffic Signal, Vehicle Tail Light
  - Street Light, Indoor Lamp
- New Mass Market
  - New Numerous Applications
  - Various Transmitter/Receiver Devices

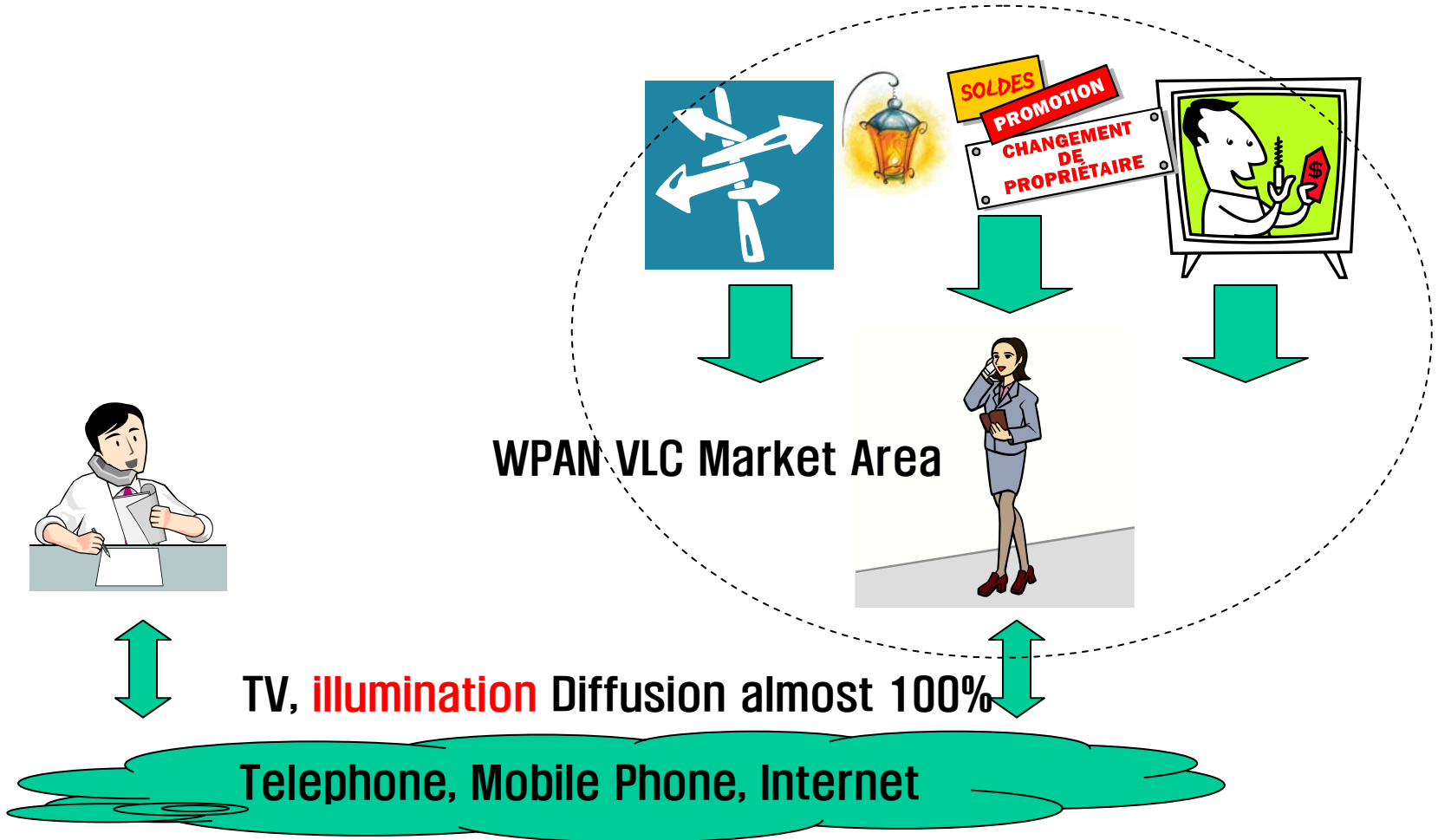
# One Lighting Source



# Starting LED Performance Burst



# Creation a New Market Area by VLC



# LED Advantages as a Light

- Power Saving
  - Use only 10% power than before
- Long Living
  - Longer 10 times (about 50,000 hours)
- Conservation of nature
  - No Mercury
  - Better waste treatment

# VLC Expectation

- Do you think that LED will be replaced traditional lighting?
- How many %, when?
- Can you imagine another LED Applications?



# VLC Application Areas

- Inter Mobile handsets
  - Mobile handset, MP3, Notebook
- LED Display to handset
  - Handset, TV, Signboard
- Inter Vehicles
  - Taillight, Headlight, On-and-off light
- Lamp applications
  - Indoor illumination, Traffic signal, Route beacon

# VLC Application Specific Requirements

- Short Range High speed
- Long Range Low speed
- Multiple channels
- One-way or two-way
- Symmetry or asymmetry speed
- Support Media: voice, data, video

# Short Range High speed Requirement

- Applications
  - Inter Mobile handsets
    - Mobile handset, MP3, lap top Notebook
  - LED Display to handset
    - Handset, TV, Signboard
- Range
  - 0 - 3m
- Speed
  - 0 - 10 Mbps
- Light Interference
  - Weak: Indoor, Night

# Long Range Low speed Requirement

- Applications
  - Inter Vehicles
    - Taillight, Headlight, On-and-off light
  - Lamp applications
    - Indoor illumination, Traffic signal, Route beacon
- Range
  - 0 - 100m
- Speed
  - 0 - 1 Mbps
- Light Interference
  - Strong: Outdoor, Daylight, Fog

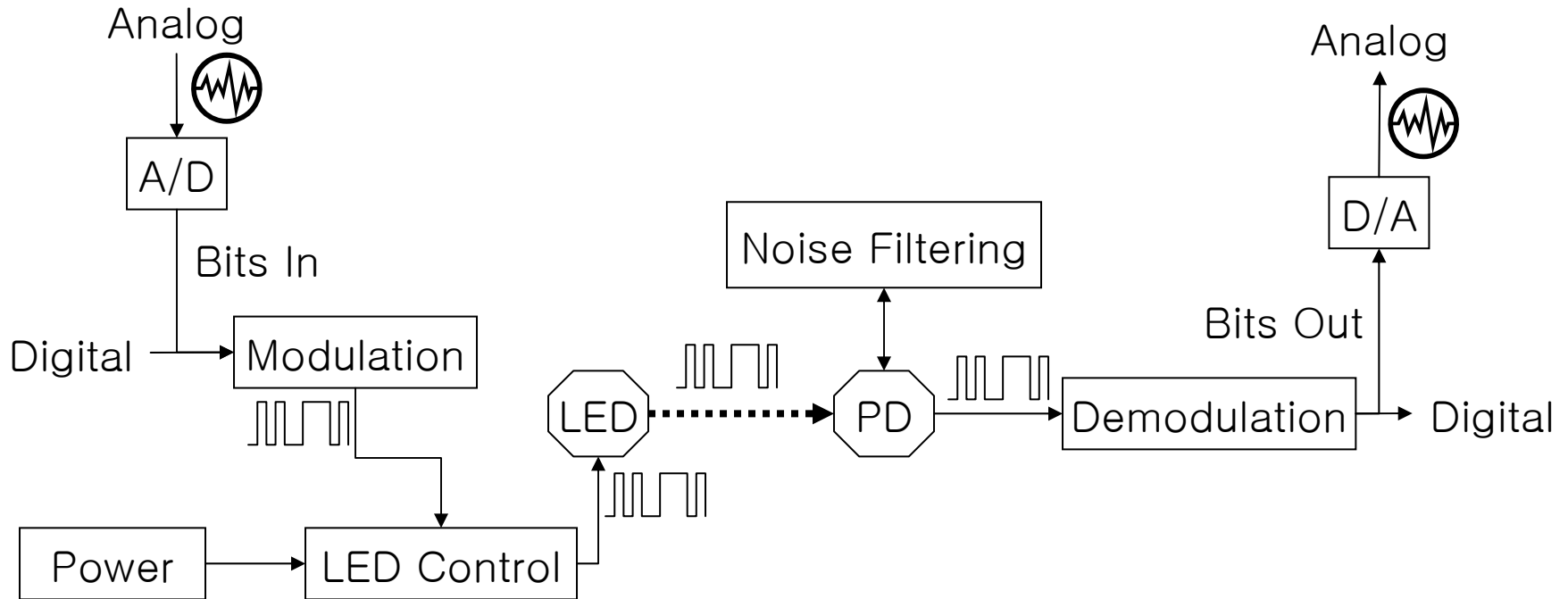
# VLC PHY Standard Issues

- Sending Part
  - LED standard interface
  - Illumination/transmission performance
- Receiving Part
  - PD standard interface
  - Avoidance from any other light interference
- Common Part
  - VLC Modulation
  - VLC Architecture

# VLC PHY Architecture

VLC Sending Part

VLC Receiving Part



# VLC MAC Standard Issues

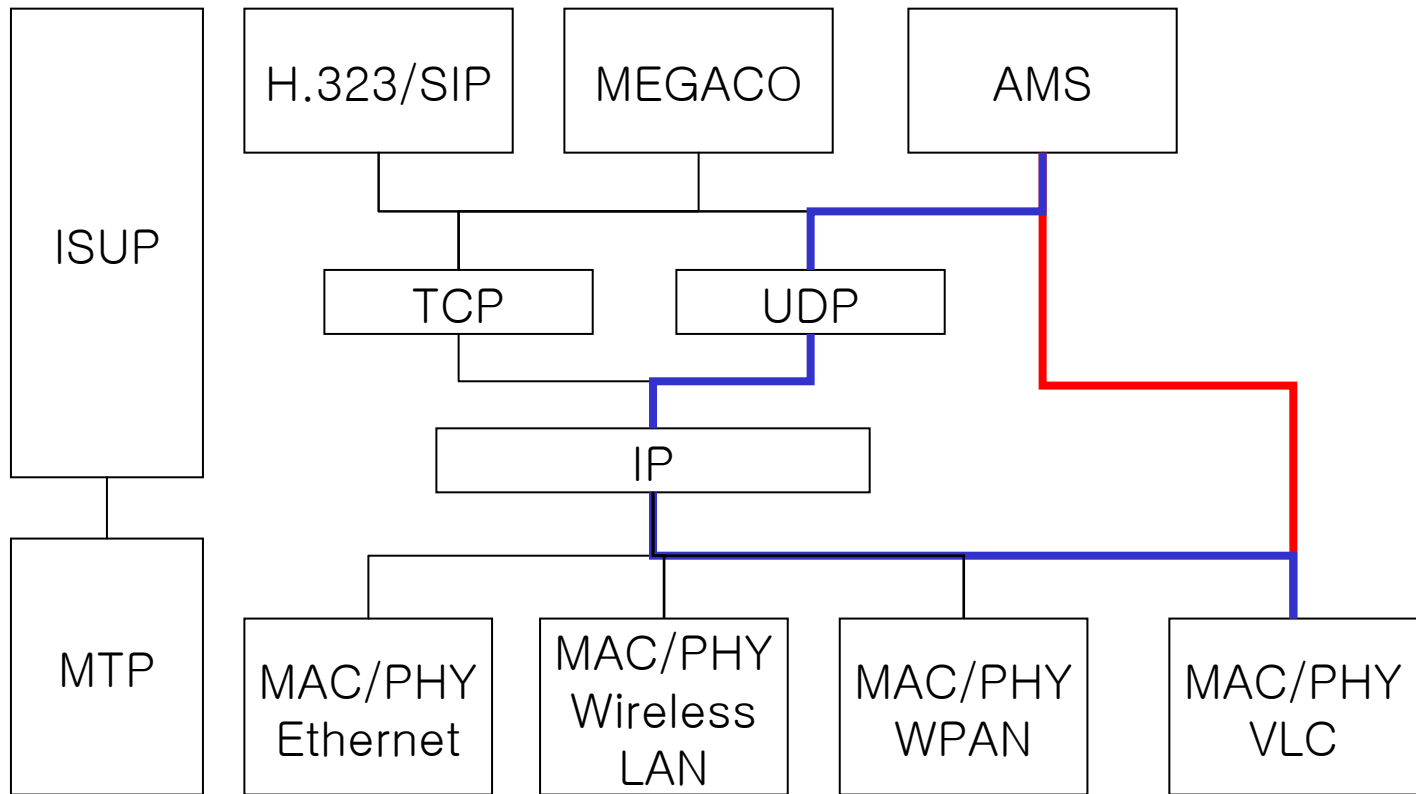
- LAN Connection
  - Both way
- Broadcasting Only
  - One way
- Machine-to-Machine
  - Inter operation

# VLC Application Protocol Standard Issues

- Why
  - IEEE 802.15 focused on PHY and MAC
  - Does not care Application Protocol Part
  - But, Application Part is also important one as well as PHY and MAC for VLC
- Where
  - ITU-T SG 16 AMS (Advanced Multimedia System)
  - One of candidates that creating future multimedia services



# VLC Application Protocol Stack



AMS: Advance Multimedia Service, SIP: Session Initiation Protocol, ISUP: ISDN User Part

# Vision for VLC

- Fusion Industry Creation
  - LED industry: LED Driver, Lighting, Display
  - Communications industry: Telecommunication, Ubiquitous, ITS
- Standardization
  - Relationship inter-organizations: IEEE 802.15 WPAN, ITU-T SG16 AMS, VLCC, TTA VLC WG, The Fully Networked Car
  - TTA 2008 VLC Standard Roadmap
- Market
  - New Communication with LED applications: Vehicle, Signboard, Streetlight, Traffic Signal
  - New Functions: LBS, Security, New Frequency Bandwidth, Sensing

# Further Discussions

- Integration or Separation
  - PHY and MAC
  - Transmitting and Receiving
  - Per Application
    - Short range high speed, Long range low speed, etc
- Further Consideration
  - Compatibility for VLC devices
  - Compatibility for LED/PD Interfaces
  - Feasibility for VLC market