IP-KVM

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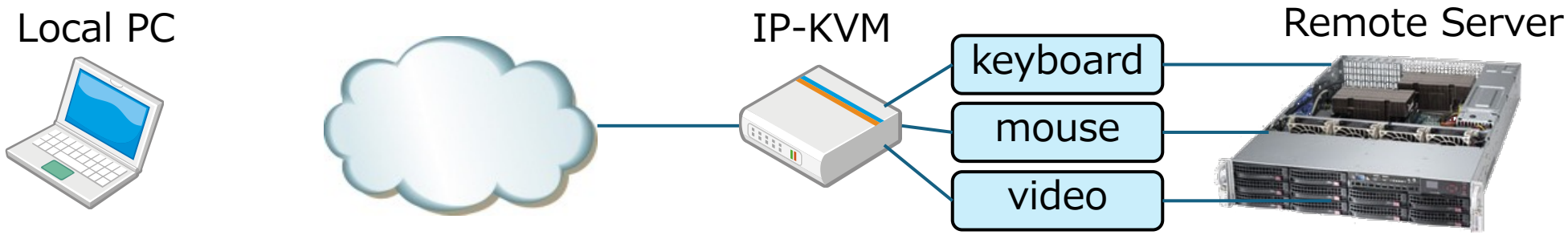
KVM (Keyboard, Video, and Mouse)

- To access a PC/Server console
  - BIOS setting
  - OS installation
  - Boot issue troubleshooting
- Bulky
- Suddenly becomes necessary
- Can’t handle remote devices

IP-KVM in general

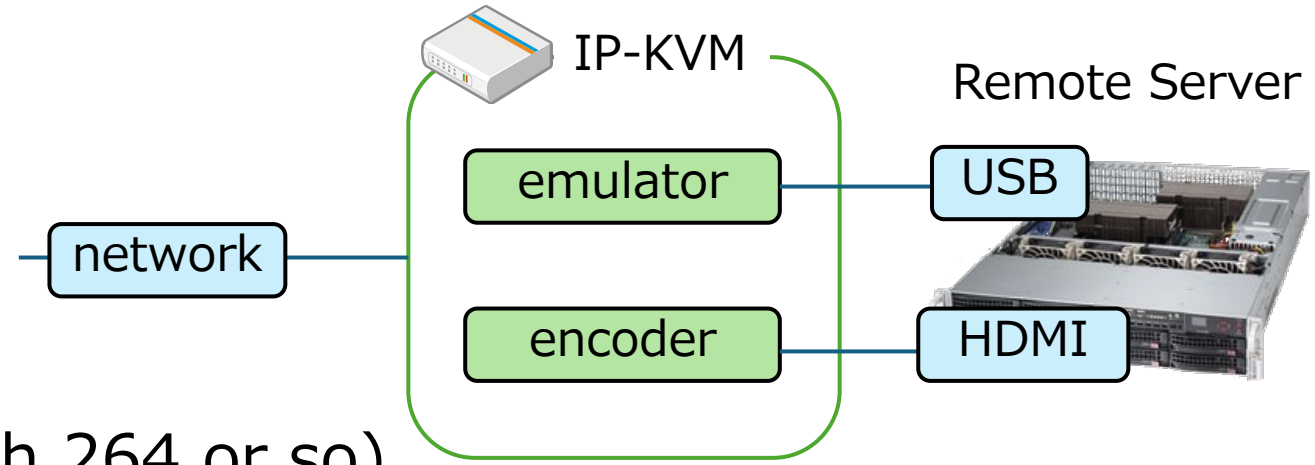
- An IP-KVM allows remote keyboard, video, and mouse control over IP networks, enabling server management without physical access



Able to control the remote server via the IP-KVM

IP-KVM Elements

- USB Device Emulation
  - Keyboard
  - Mouse
  - USB memory, CD drive
  - Network
- Video Streaming
  - Capturing and Encoding (h.264 or so)
- Control via Network
  - Proprietary application
  - Web UI



OS Installation via IP-KVM

1. Connect to the server via IP-KVM interface
2. Mount an ISO image or bootable media through virtual media feature
3. Access BIOS/UEFI settings if needed
4. Launch the OS installer
5. Complete the installation using IP-KVM’s keyboard and mouse control

Price Evolution Overview

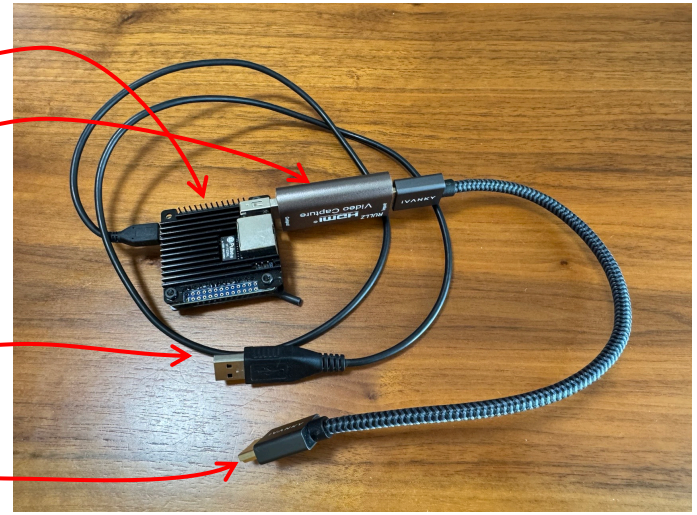
- 2000s
  - Enterprise-grade solutions
  - ~ $5000 USD
- Late 2010s
  - Emergence of DIY solutions based on Pi
  - ~ $500 USD
- Late 2020s
  - Proliferation of budget-friendly devices
  - ~ $100 USD and getting cheaper

DIY IP-KVM Required Components

- Single-board computer (SBC)
  - Main controller (e.g., Raspberry Pi, etc.)
- HDMI capture interface
  - Captures display output (e.g., MS2130 chip dongle, etc.)
- MicroSD / Storage media
  - Stores the operating system and IP-KVM software
- USB cables, power supply
- IP-KVM implementation
  - e.g., https://github.com/pikvm/pikvm and such

My DIY IP-KVM trial - about 70USD

OrangePi Zero LTS	30 USD
HDMI-USB capture dongle	30 USD
MicroSD card (32GB)	5 USD
USB cable	existed
HDMI cable (30cm)	4 USD



You might consider:

3-way USB cable

To supply power for the SBC(Pi) from a separate device

A modern HDMI capture dongle

MS2130 chip HDMI-USB capture dongle

My DIY IP-KVM result

- **Works, but…**
  - I have installed OS by my DIY IP-KVM
- **Some Instability ☹**
  - The server I manage by my DIY IP-KVM hung up
  - It seems unstable USB Device Emulation caused the issue

- A product seems more stable at this moment
  - The situation will be changed through the development of the open source projects

Applicable areas

- Personal Hobby Server Management
  - Servers operated in headless mode
- Local OS Installation
  - Useful for trying out several OSs

- … Remote Business Server Management?
  - Considerations?
  - Especially in terms of security
    - Console access is too powerful; can do anything

Security Threats in IP-KVM Usage

- **Unauthorized Remote Access**
  - Default credentials or weak passwords may allow attackers to gain control
  - Risk: Full keyboard, mouse, and video control of the system
- **Unencrypted Communication**
  - Some IP-KVMs transmit data over unsecured channels (e.g., HTTP, unencrypted VNC)
  - Risk: Man-in-the-middle (MitM) attacks, credential theft
- **Open Network Ports**
  - IP-KVMs often expose web, SSH, or VNC ports
  - Risk: Port scanning and brute-force attacks by external actors
- **Poor Access Logging and Monitoring**
  - Lack of auditing makes intrusion detection difficult
  - Risk: Breaches may go unnoticed
- **Backdoors and Hardcoded Credentials**
  - Especially in low-cost or poorly reviewed models
  - Risk: Attacker may retain hidden access

Mitigation of IP-KVM Risks

- Change default credentials immediately
  - Use strong passwords
- Ensure firmware is up-to-date
- Use Secure Connection
  - HTTPS, SSH, or VPN
- Place IP-KVMs on an isolated and low-trusted network
  - Behind firewalls and limit IP access
- Monitor logs regularly for unusual activity

Operational Considerations

- Power supply to IP-KVM
  - From the target server (via USB)
    - A reboot of the server may cause temporary IP-KVM outages
  - External power supply
- Cooling system
  - Prevents overheating during operation
  - Heat sinks or Fans
- IP address of IP-KVM
  - Usually dynamic (DHCP / RA)
  - Static assignment (config or DHCP by MAC (ether) address)

Summary

- Remote Access
  - Full console access to servers from anywhere, even during boot or OS failure
- Deployment Convenience
  - Useful for installing and managing multiple operating systems
- Security is still a big concern
  - Console access is powerful, the IP-KVM might not be trusted
  - Consider risk mitigations