

High Speed Interface for Various Applications

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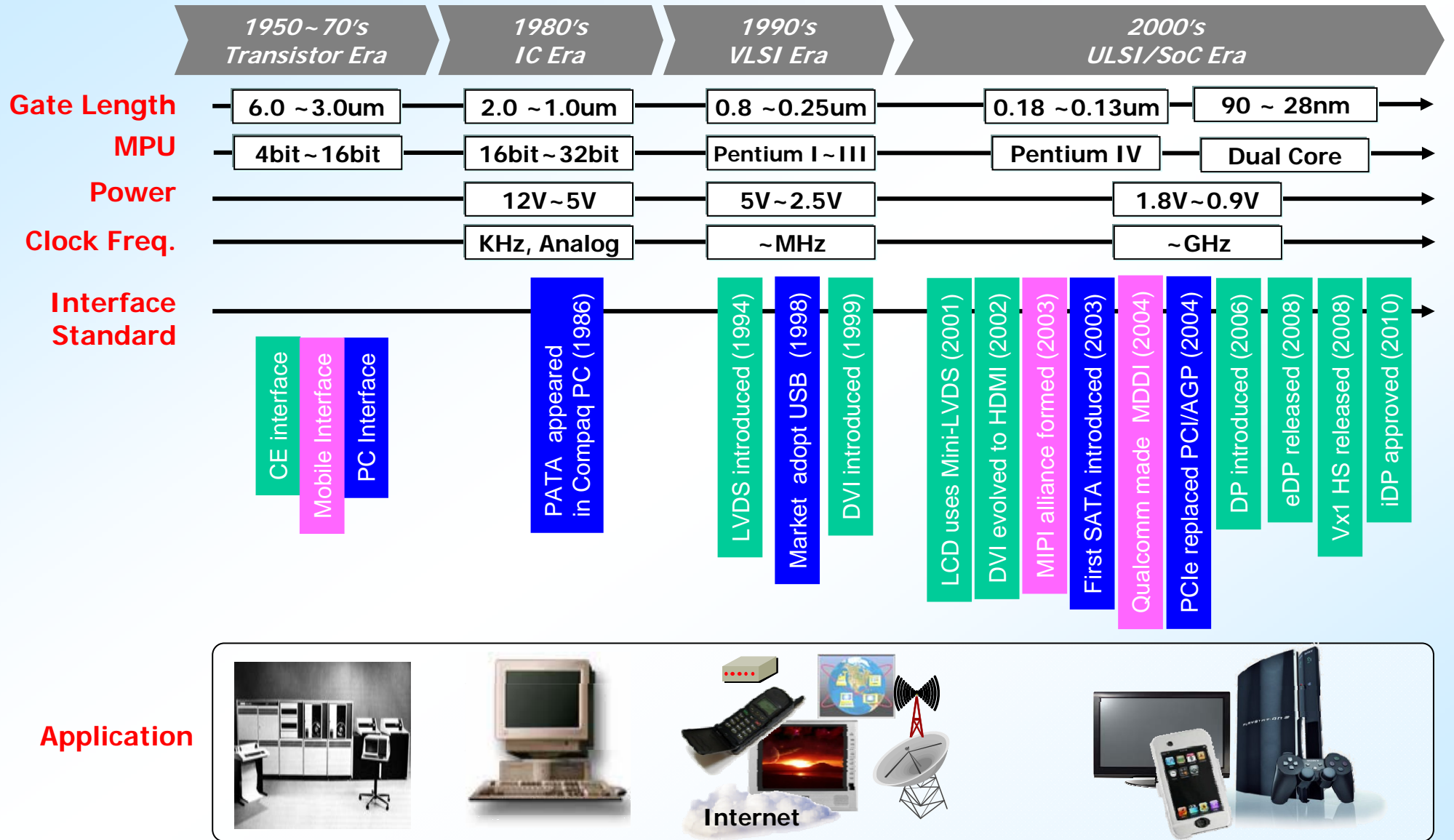
2010. 10.15

 **LG Electronics / Bo-ik Sohn**

1. Overview

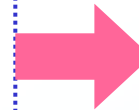
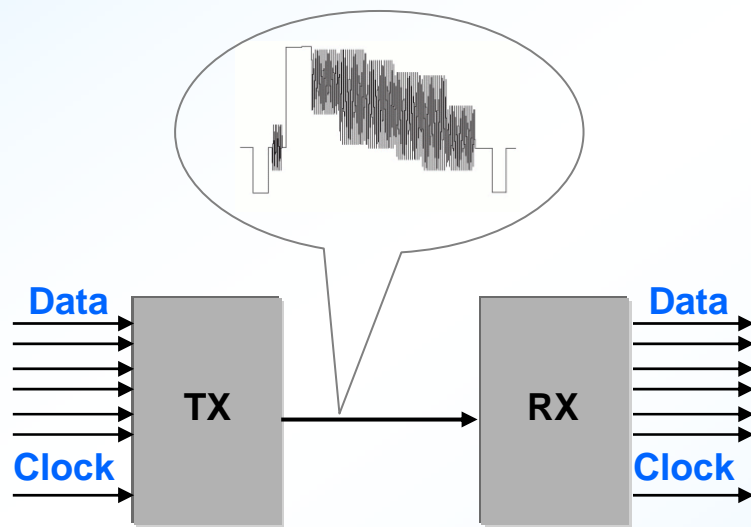
- **History of Industry**
- **Why Digital Interface?**
- **Why High Speed Interface?**
- **HDMI Example**

1. Overview



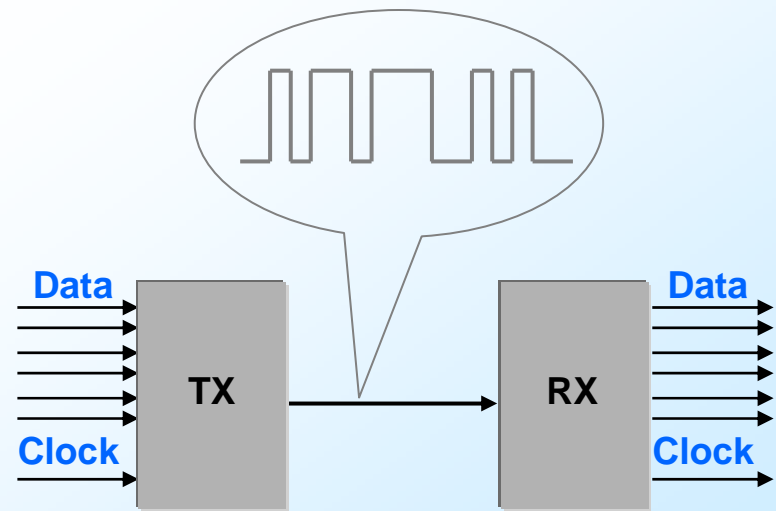
ANALOG I/F

- Limited Bandwidth
- Vulnerable to Noise
- DA conversion for Digital Source & AD conversion for Digital Sink



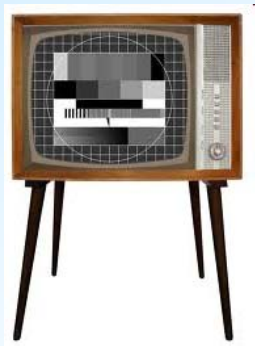
DIGITAL I/F

- Increased Bandwidth
- Better Noise Immunity
- Convenient for Digital Source & Sink
- Easy to Achieve High Data Rate



ANALOG ERA

DIGITAL ERA



B/W TV

Signal reception?



Color TV

Color image quality?



Digital TV

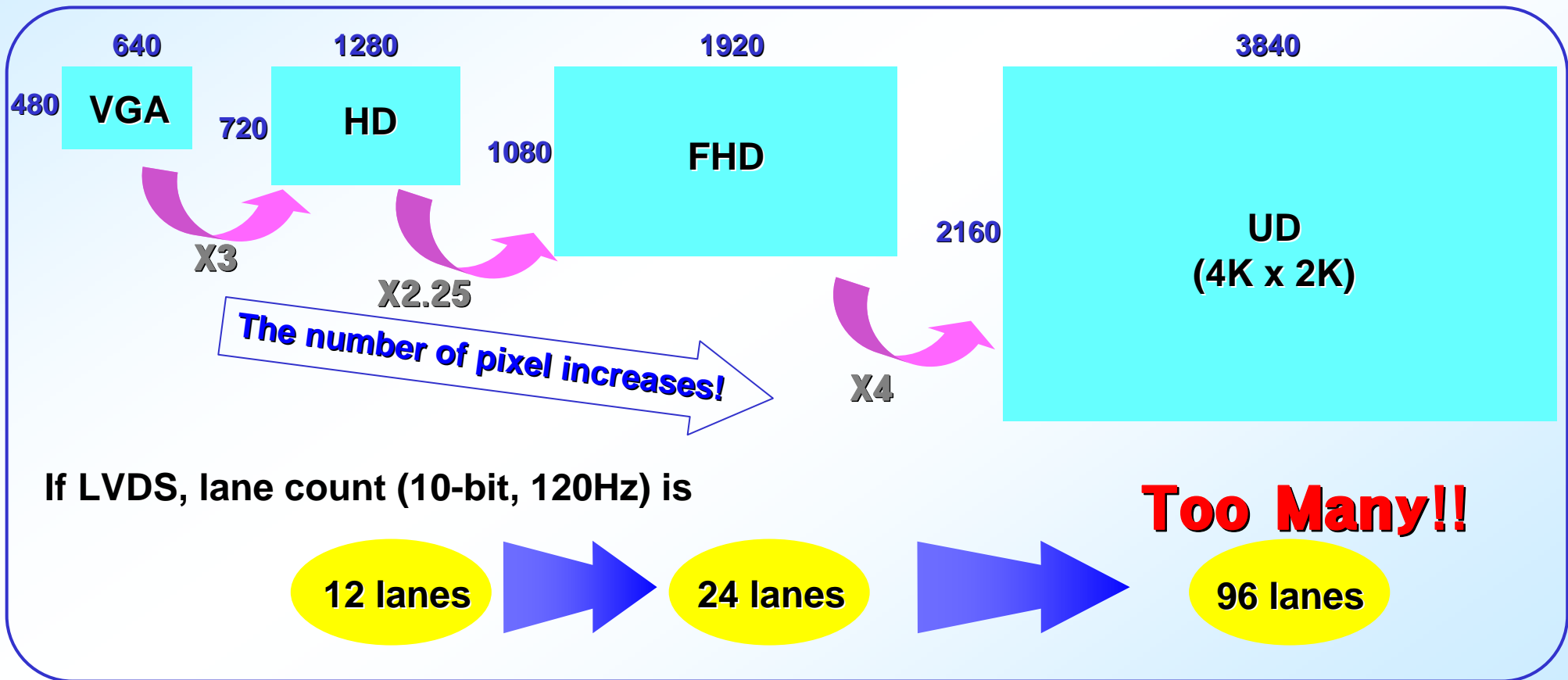
High resolution?
High frame rate?
Interface?
3D Video?
...



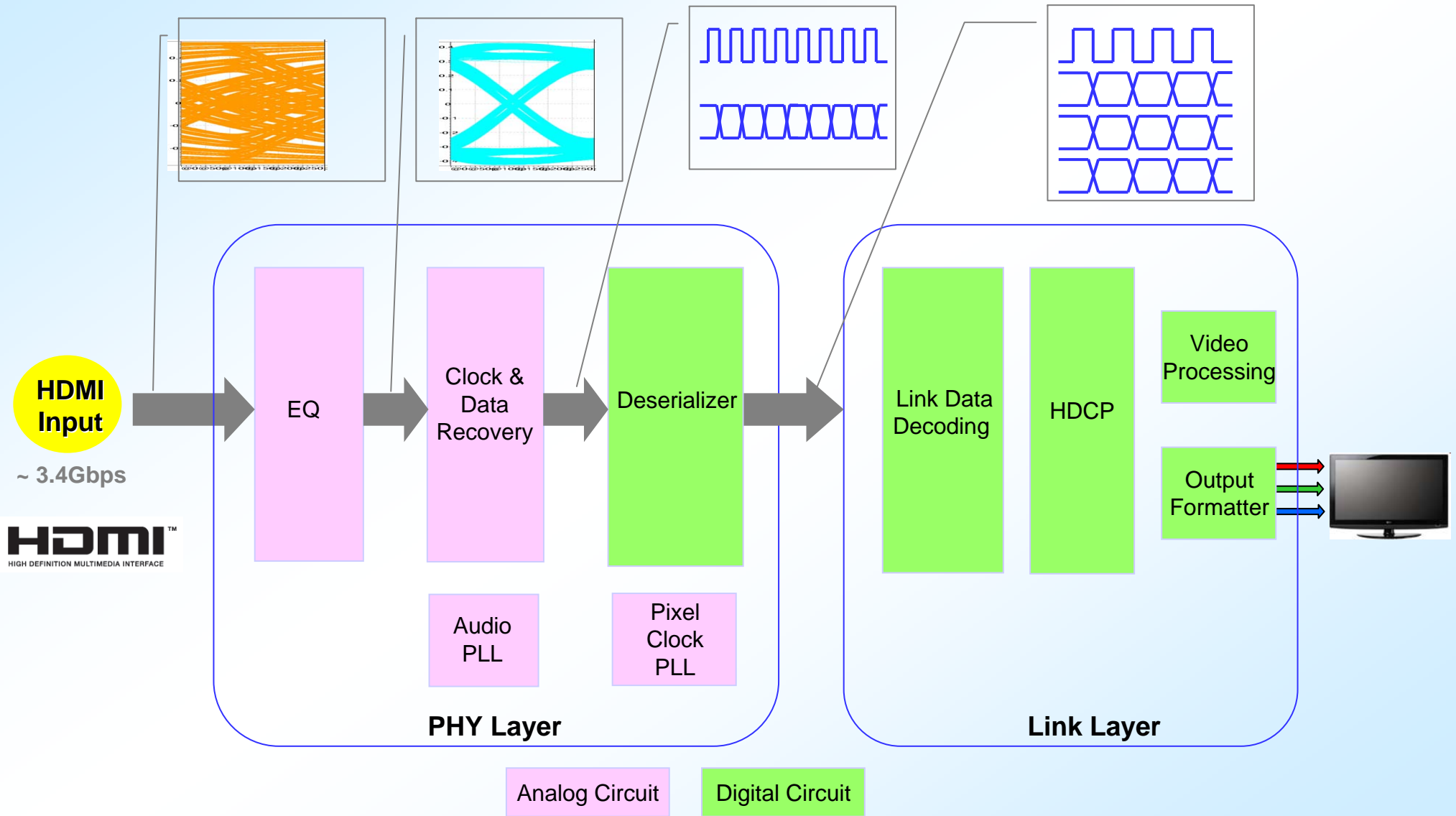
Smart TV

...
Extended Interface?
...

- Bigger display and higher resolution drastically increase the pixel data to be transmitted over cables.



1. Overview



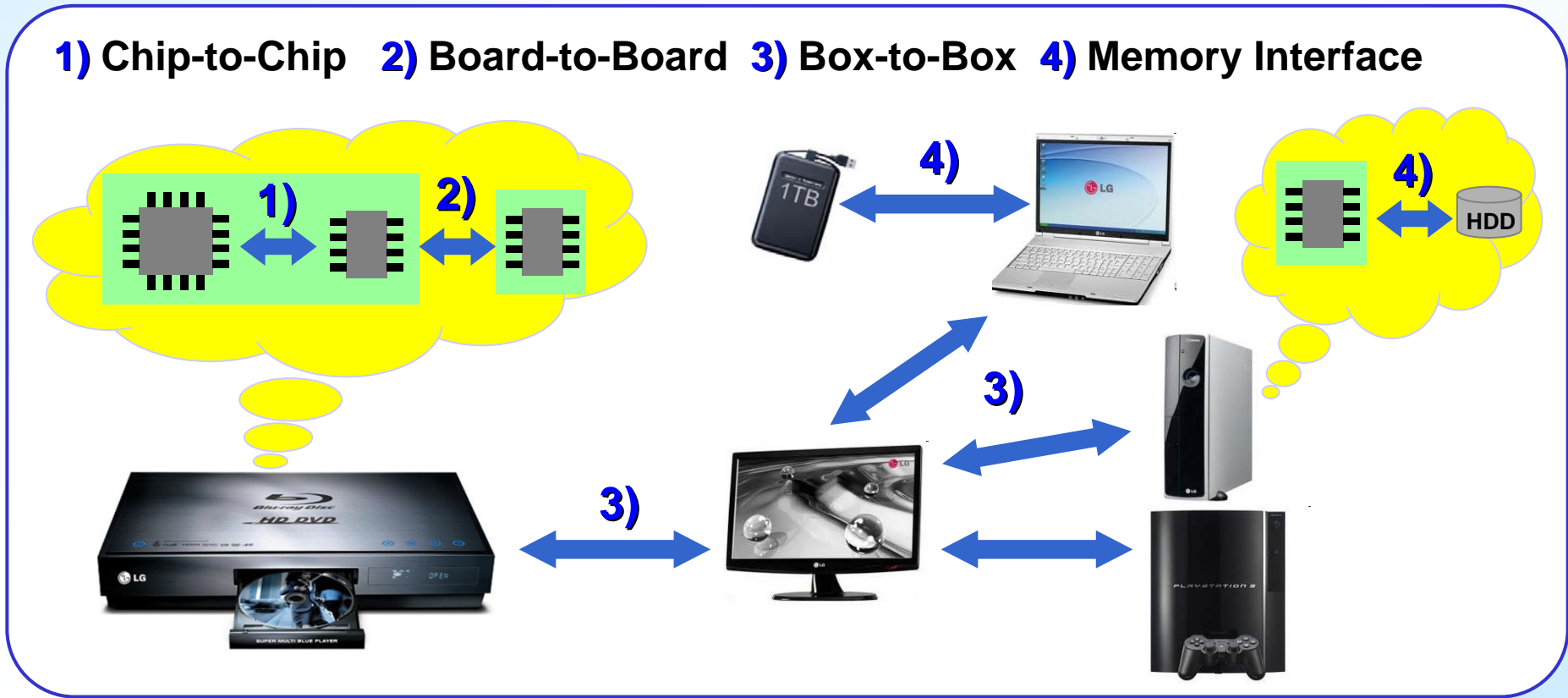
2. Technical Basics

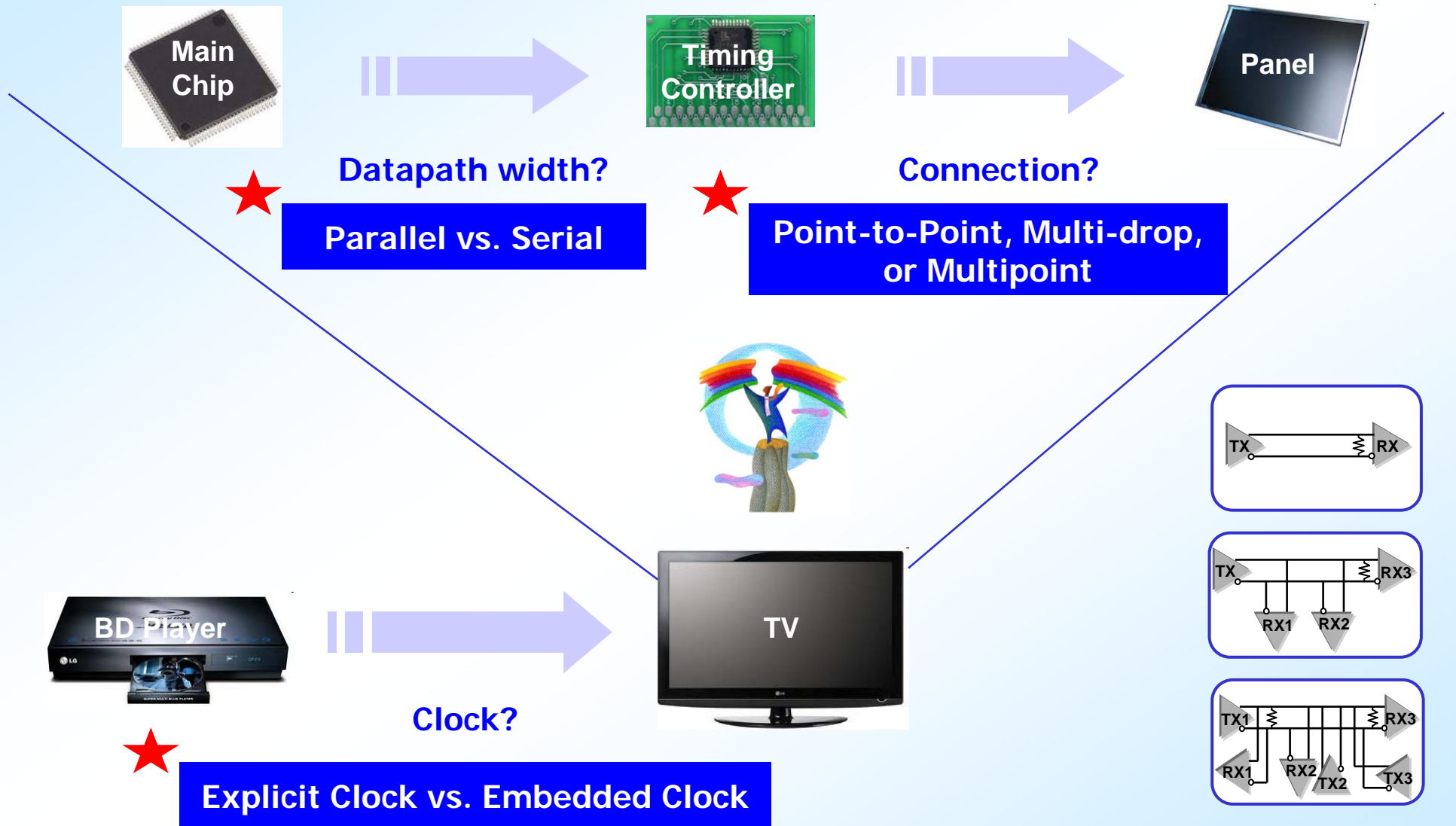
- **Inter and Intra Interface**
- **Clock, Datapath, Topology**
- **Limiting Factors & Countermeasures**

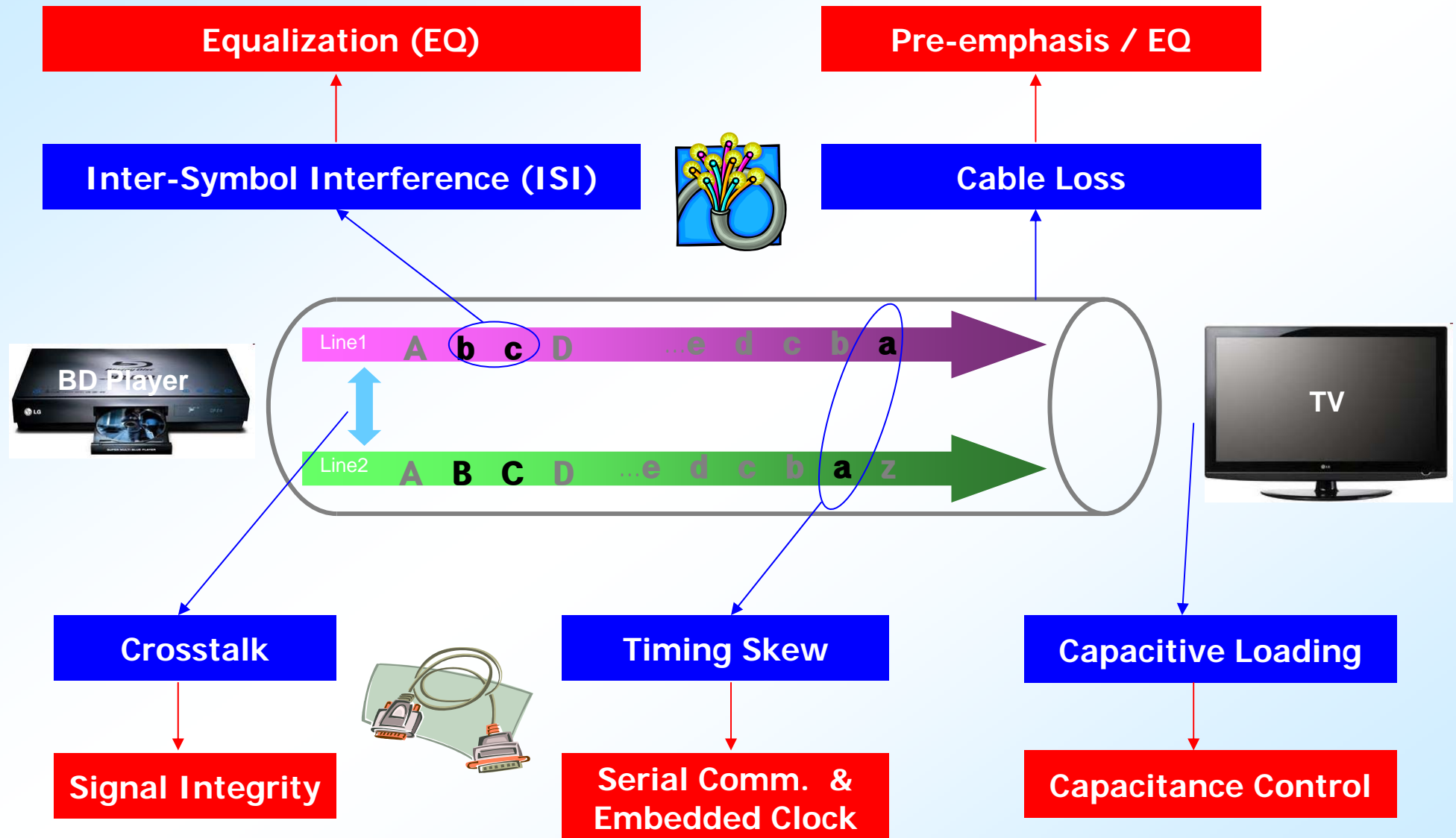
System Performance depends on

“Inter-Component Interface” > Intra-Chip Technology

- 1) Chip-to-Chip 2) Board-to-Board 3) Box-to-Box 4) Memory Interface



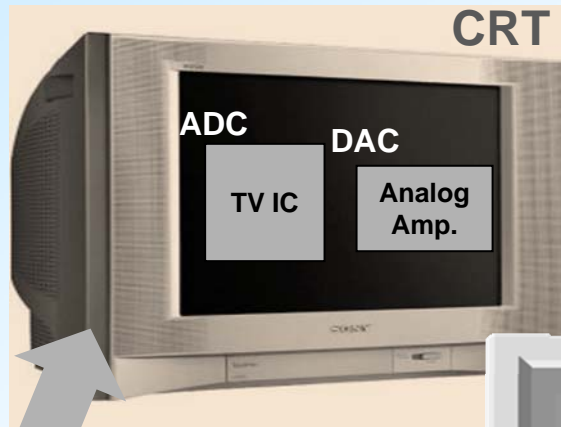




3. Applications

- **TV Interface**
- **PC Interface Evolution**
- **PC Interface Architecture**
- **Mobile Interface**
- **Mobile Interface Example**

3. Applications



Analog I/F → **Digital I/F**
Digital Serial I/F

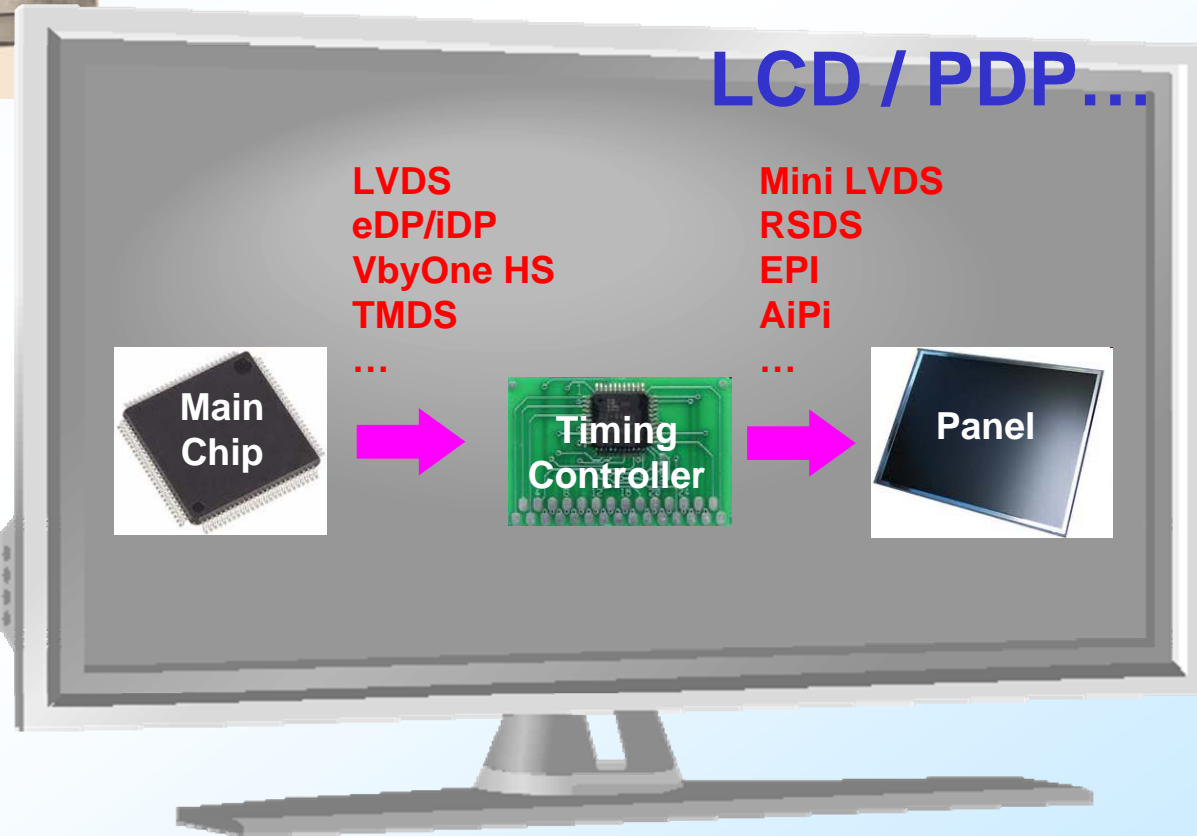
Analog I/F

- D-Sub
- Composite
- Component
- S-Video

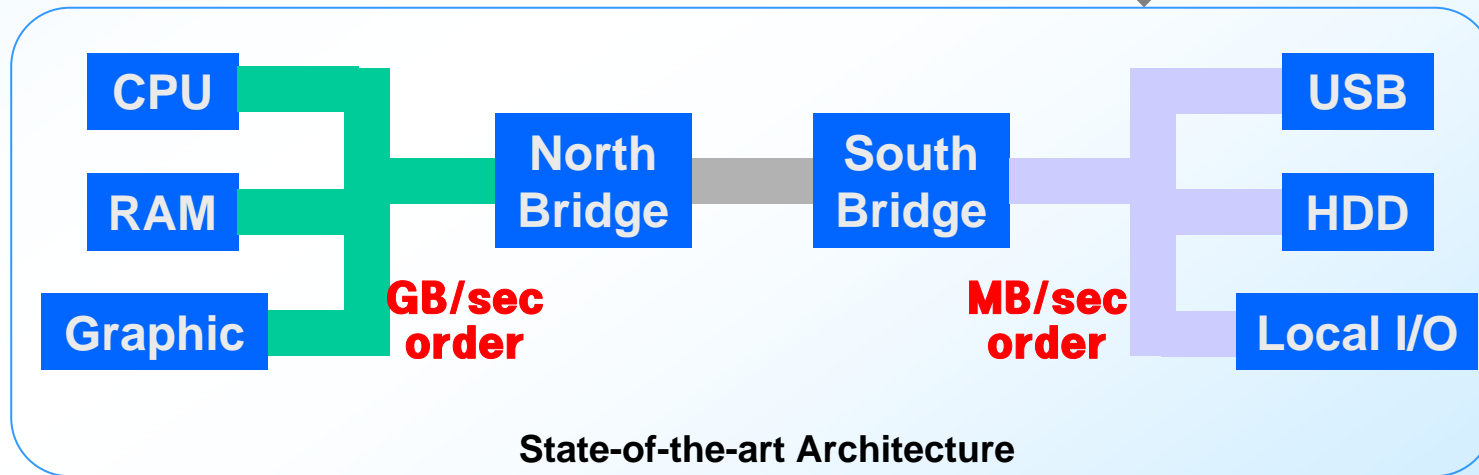
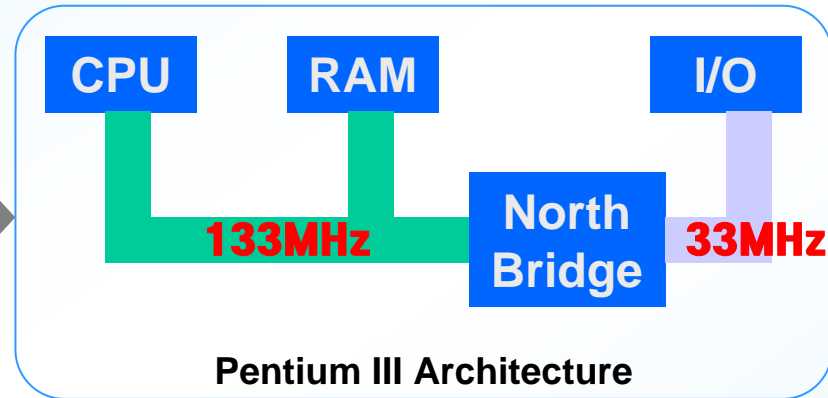
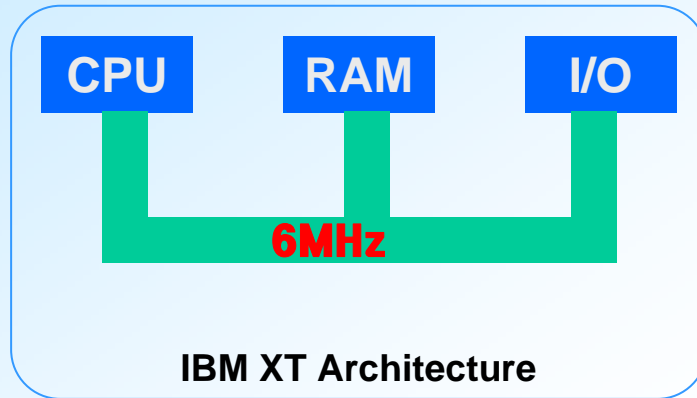


Digital I/F

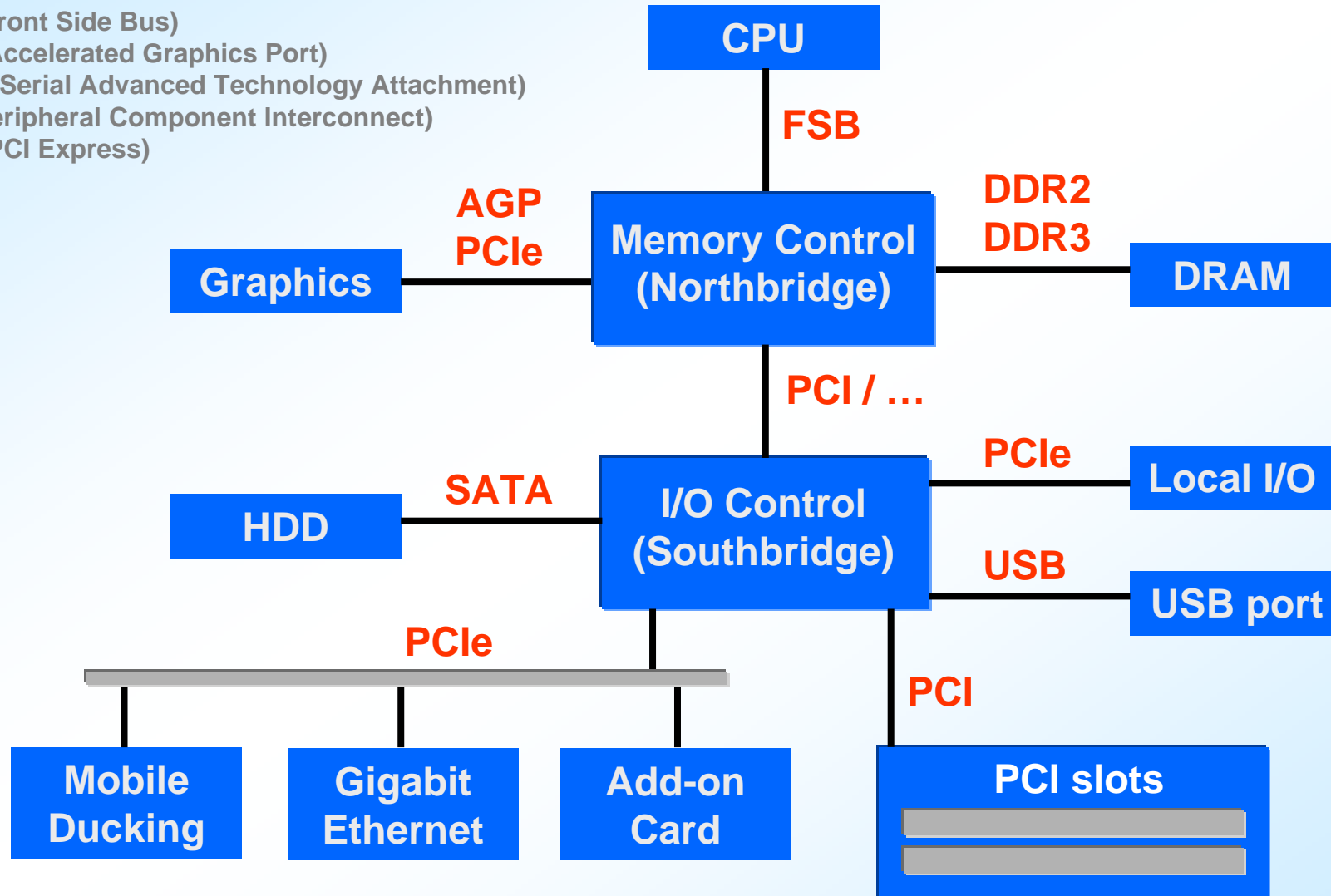
- DVI / HDMI
- DisplayPort
- DIIVA
- ...



3. Applications

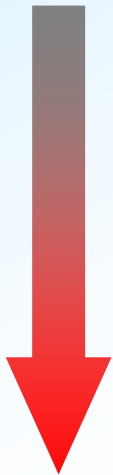
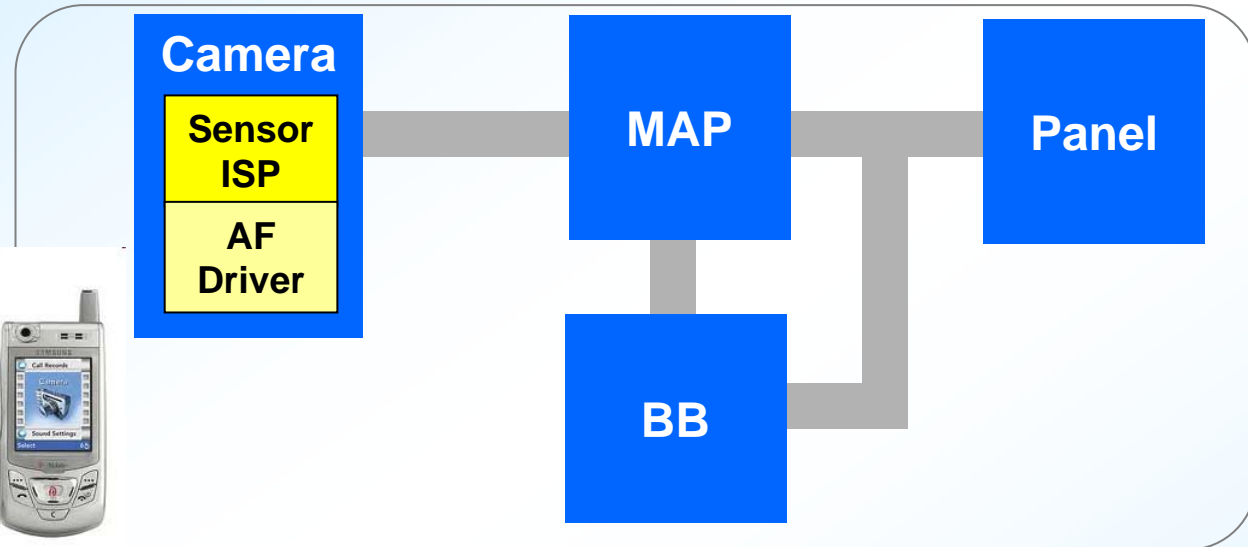


FSB (Front Side Bus)
 AGP (Accelerated Graphics Port)
 SATA (Serial Advanced Technology Attachment)
 PCI (Peripheral Component Interconnect)
 PCIe (PCI Express)

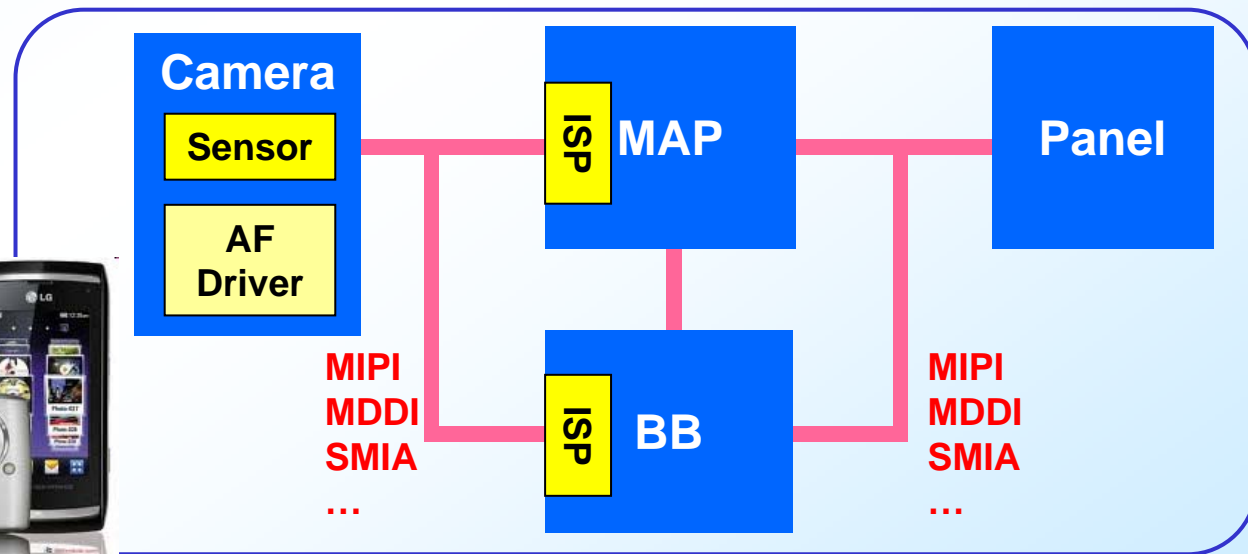


3. Applications

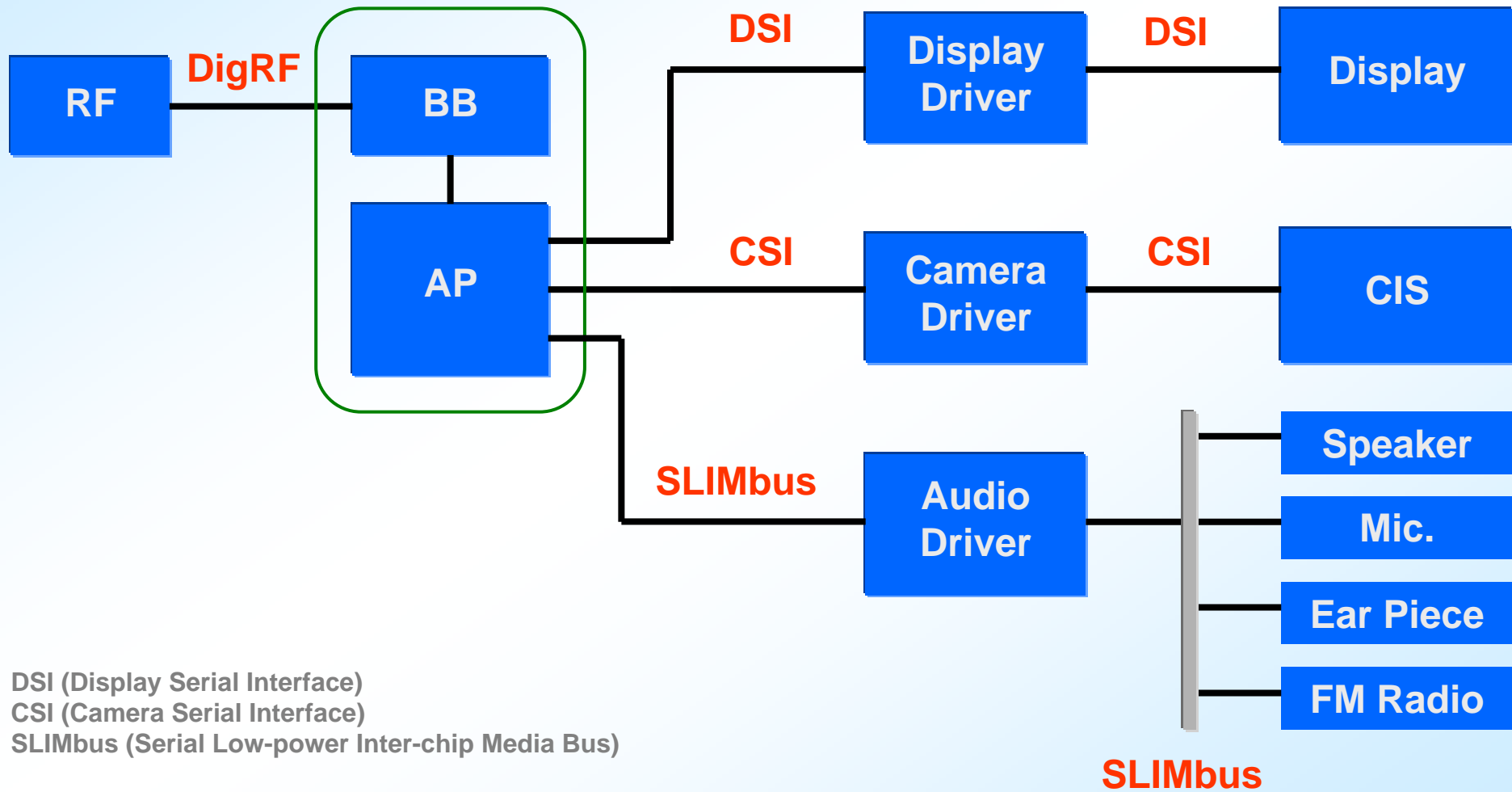
Parallel I/F



Serial I/F



● **Current Mobile Architecture using MIPI Standard**

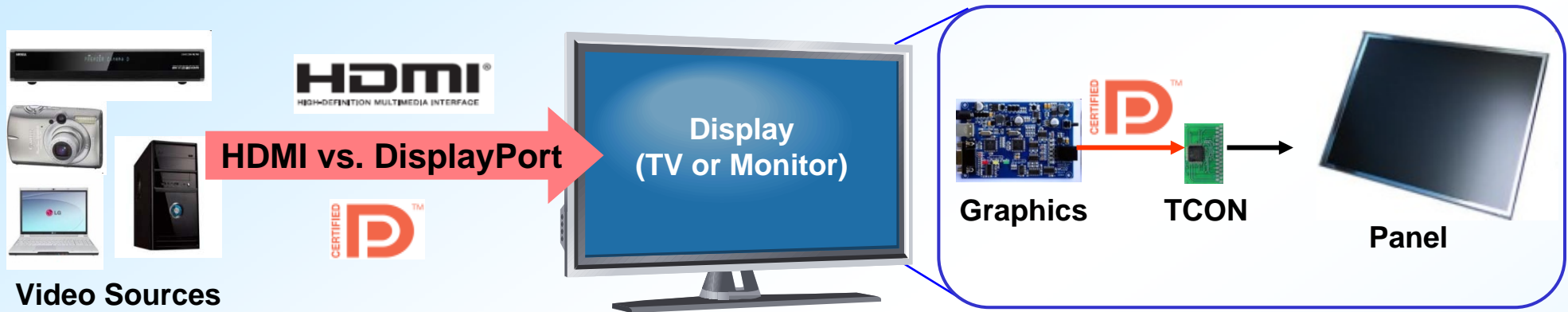


4. Winning Game

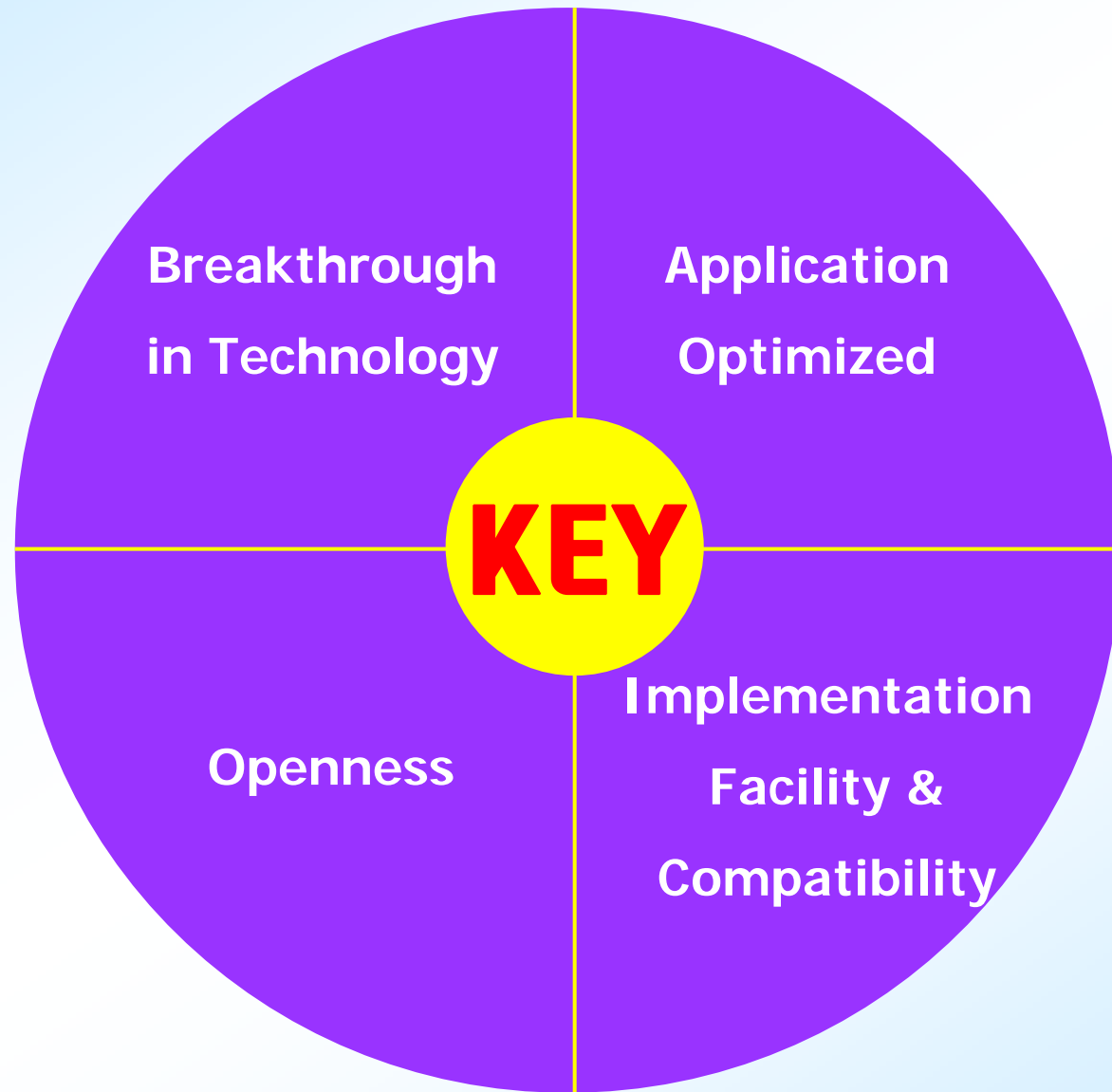
- **Competition Example (HDMI vs. DP)**
- **Keys for Successful Interface Standard**
- **Winning Shots**

4. Winning Game

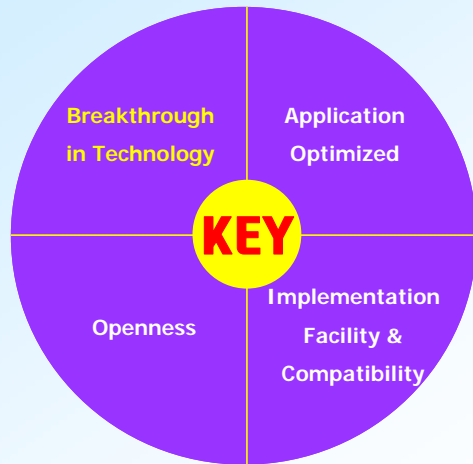
Competition Example (HDMI vs. DisplayPort)



	HDMI	DisplayPort
Initial Release	2002	2006
Current Version	HDMI 1.4 (2009)	DP 1.2 (2010)
Controlling Authority	HDMI LLC	VESA
Major Application in Current Market	TV	Monitor
Remarks	<ul style="list-style-type: none"> • Industry de facto standard for Consumer Electronics • Needs royalty / licensing fee • Networking feature added (LiquidHD) • Companion Interface Standard introduced (MHL, SPMT) 	<ul style="list-style-type: none"> • Intended for both External and Internal interfaces • PC & Monitor application • Open standard; royalty-free • Several Derivatives : eDP, iDP, tDP



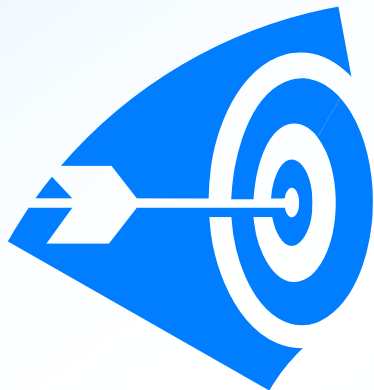
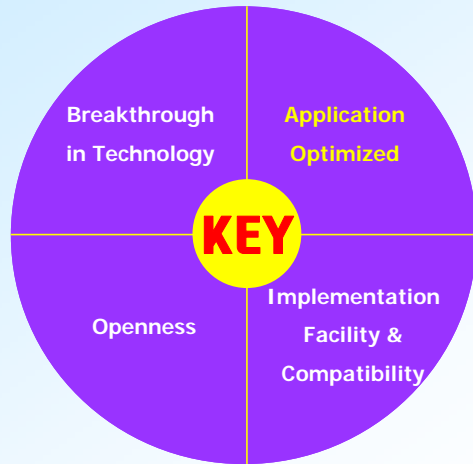
● What brings you success ?



1. Breakthrough in Technology

- Superb performance.
ex) Yes, Analog to digital. D-SUB(RGB) → DVI
SD to Full HD with 120Hz LVDS → iDP, V by One HS
- Upgradeable standard
ex) HDMI 1.0 → HDMI 1.4
DP 1.0 → DP 1.2
- Provide Roadmap: Show what the future will look like.
ex) SATA Gen1(1.5Gbps) → SATA Gen2(3Gbps) →
SATA Gen3(6Gbps)
- Low cost.
ex) Parallel Bus → LVDS

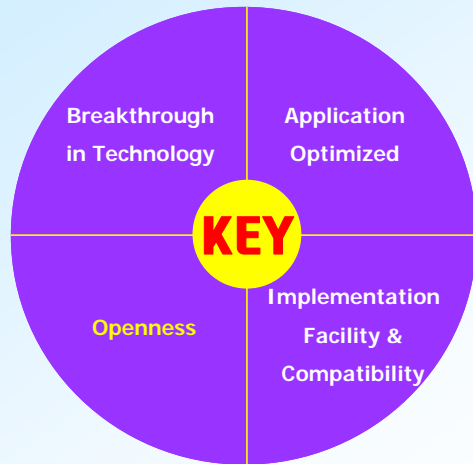
● What brings you success ?



2. Application Optimized

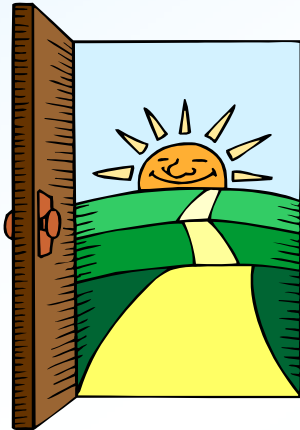
- Quickly and Seamlessly replaceable.
ex) LVDS → V by One HS(O), iDP(Δ)
Variable Pixel Clock : V by One HS(O), iDP(Δ)
- Optimized for application
ex) DisplayPort evolves
eDP for Notebook, iDP for Monitor/TV.
- Meet Demands and Lead Customers
ex) DVI (Video only) → HDMI (Video + Audio + Protection)
HDMI 1.4 : Ethernet Access and Audio Return Channel through a single cable.
Convergence: HDMI enabled PC + CE convergence.

● What brings you success ?

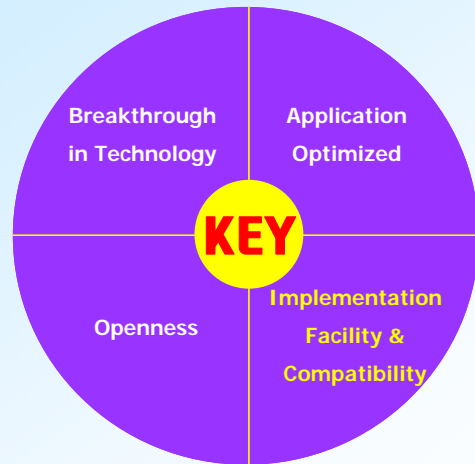


3. Openness

- Make followers, they will make your allies.
ex) Every PC monitor now has a DVI.
Silicon Image opened TMDS for DVI
- Minimum license fee
ex) DisplayPort is still alive.
V by One HS is getting popular.
They are royalty free.



● What brings you success ?

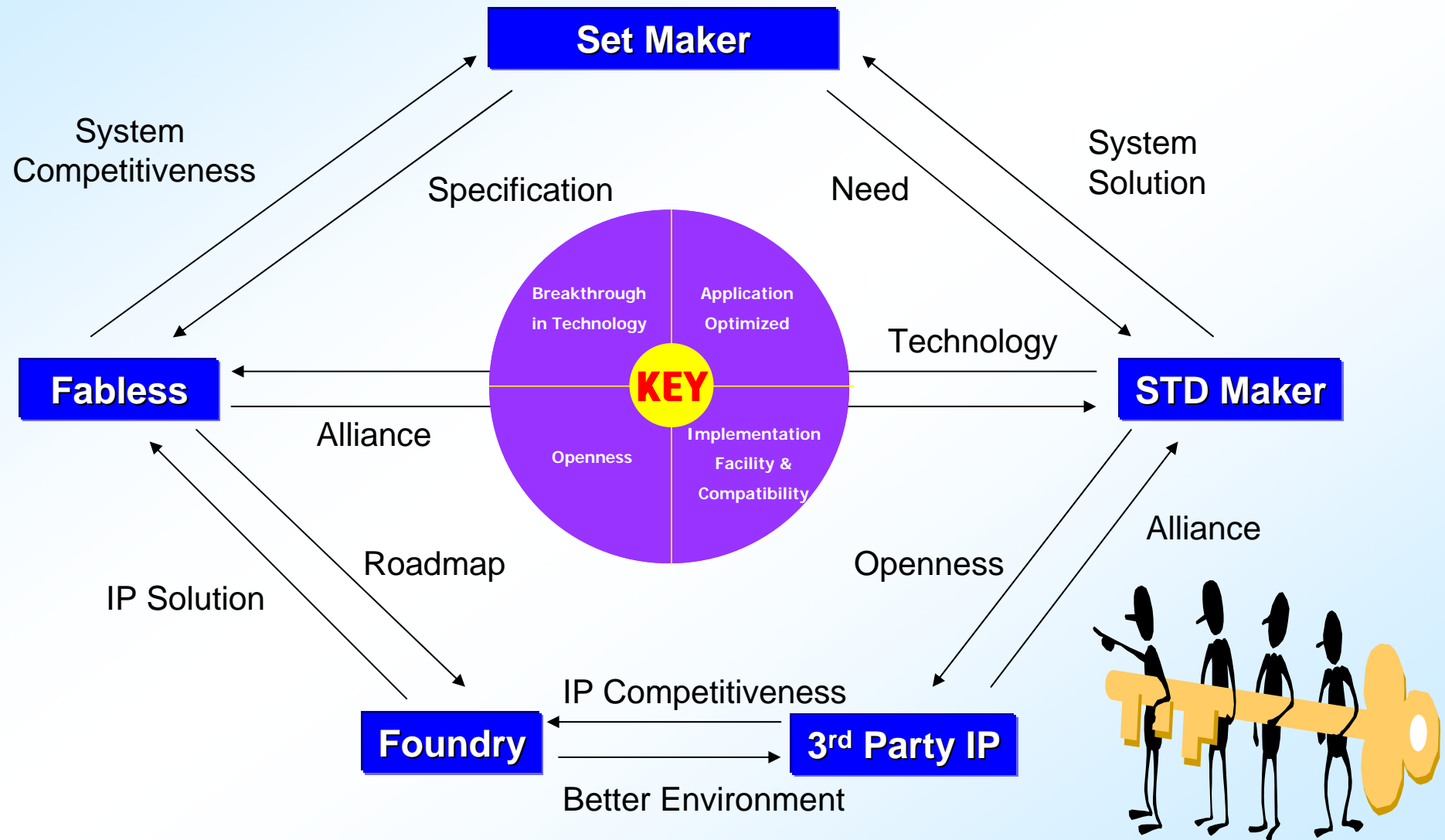


4. Implementation Facility and Compatibility

- No Proprietary Technology.
ex) Memory Interface: DDR vs. Rambus. Who won?
- Not Too sophisticated.
ex) Wireless Video: DLNA (WIFI) vs. WirelessHD (60GHz)(?)
- Confirmed Inter-operability
ex) HDMI Authorized Test Certification



4. Winning Game



5. Conclusion

“Required Data Rate” drives the Interface Technology

- Introducing 3D picture, Increased Picture Resolution, Increased Video Frame Rate,



“Interface Standard” can give you Business Opportunity

- Key of success : Breakthrough in Technology, Open Technology, Implementation Facility & Compatibility, Application Optimized



“Interface IP” is essential for Foundry Business

- Quality is 1st priority, Size is 2nd
- Need to introduce more 3rd party Interface IP





<http://www.lge.com>