



SOC Virtual Prototyping: An Approach towards fast System-On-Chip Solution

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Mamta CHALANA

Tech Leader

ST Microelectronics Pvt. Ltd, Bangalore

Agenda

- Introduction of System On Chip
- System On Chip Design Flow
- What is Virtual prototype ?
- TLM Methodology
- What is SystemC ?
- Image Co-Processor Architecture
- Image Signal Processor TLM Platform
- What is TLMdevice?
- Dataflow of the TLM platform
- TLMdevice demonstrator
- TLMdevice Benefits
- Results & Conclusions
- Thanks 😊

About the speaker..



Mamta CHALANA, did her B.Tech (Computer Science) from Rajasthan University. Since then she is working with ST Microelectronics.

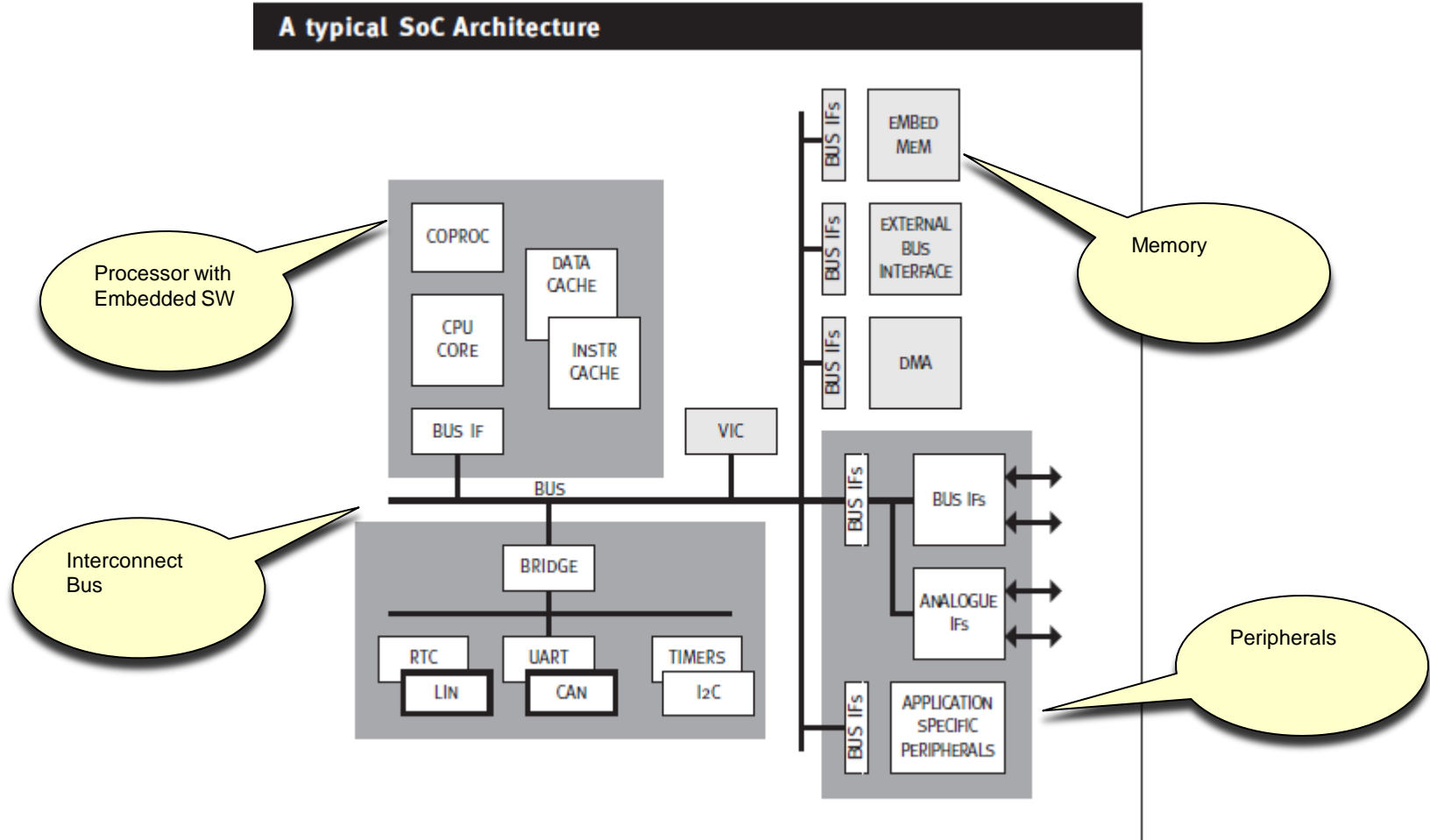
She has quite good experience of SystemC, Transaction level modeling, Functional Verification and Firmware Development.

Introduction : System On Chip

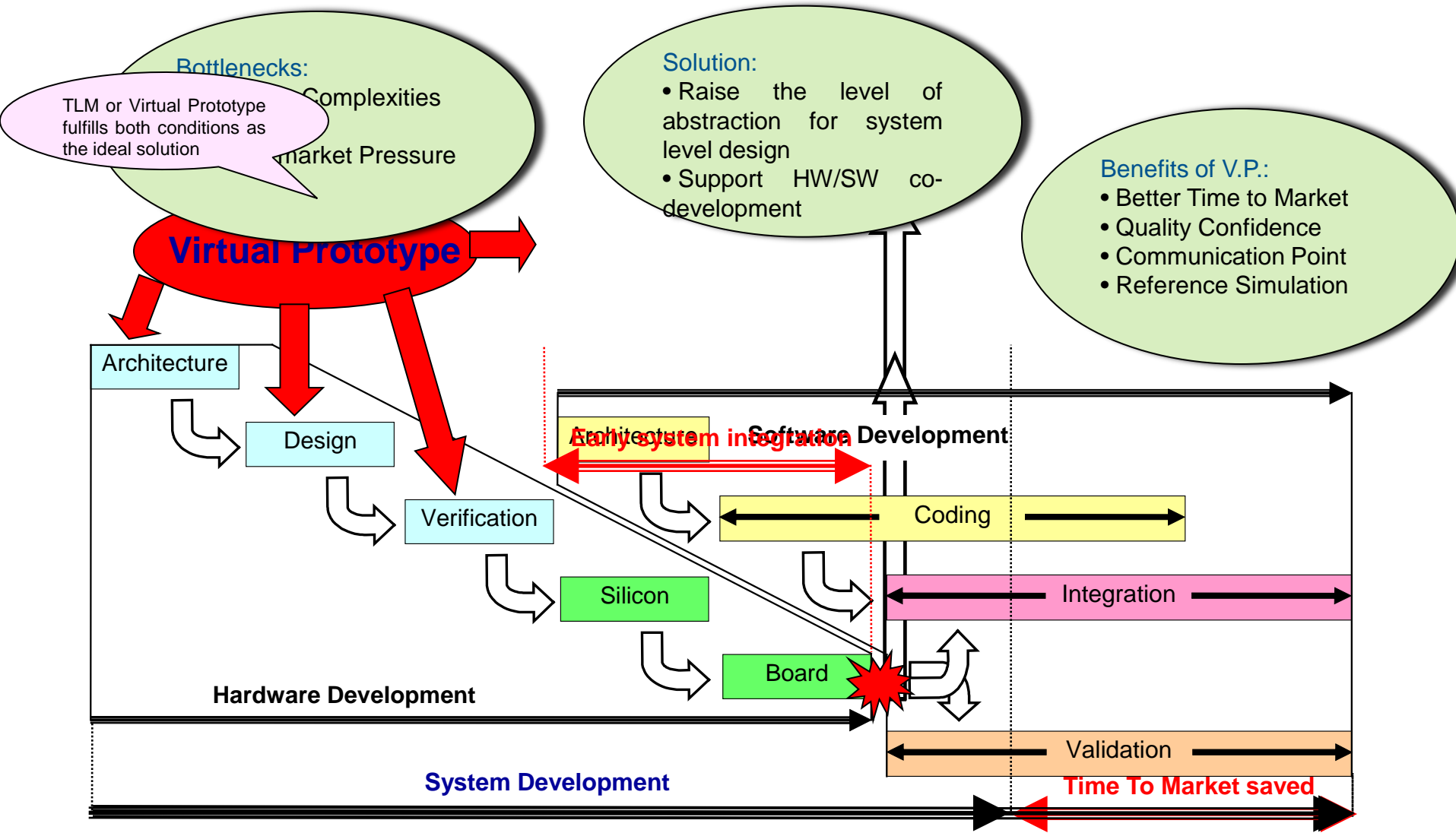


- So lets see what is System On Chip??

A typical SoC Architecture



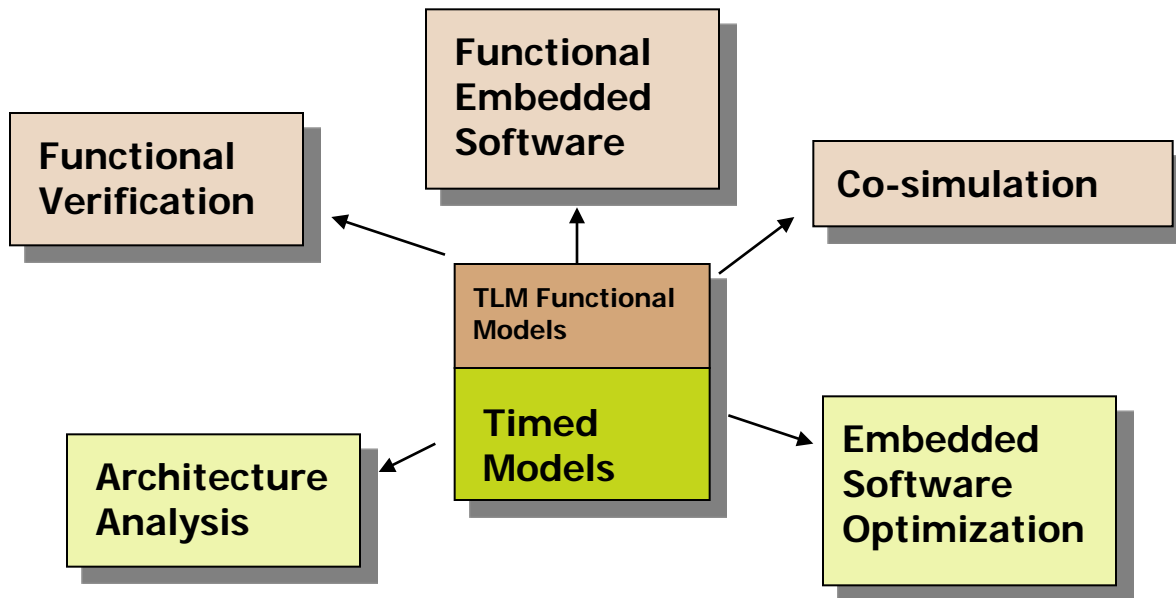
System On Chip Design Flow



TLM Methodology



- It is the single IP/SOC executable reference model that allows:
 - Rationalized modeling effort
 - Consistent development
 - Cross-team communication



- SystemC is a modeling platform
 - A set of C++ class library
 - C++ extensions to add hardware modeling constructs
 - Simulation Kernel
 - Supports different levels of abstraction like High Level Functional Models, Loosely Timed Model, Approximate Timed Models, Timed Models, Cycle Accurate models
 - Models developed in SystemC can act as unique reference model for all teams in product design phase

Image Co-Processor Architecture



The task of the Image Co-Processor is to process the data from the sensor into a good quality image conforming to a standard format (YUV or RGB)

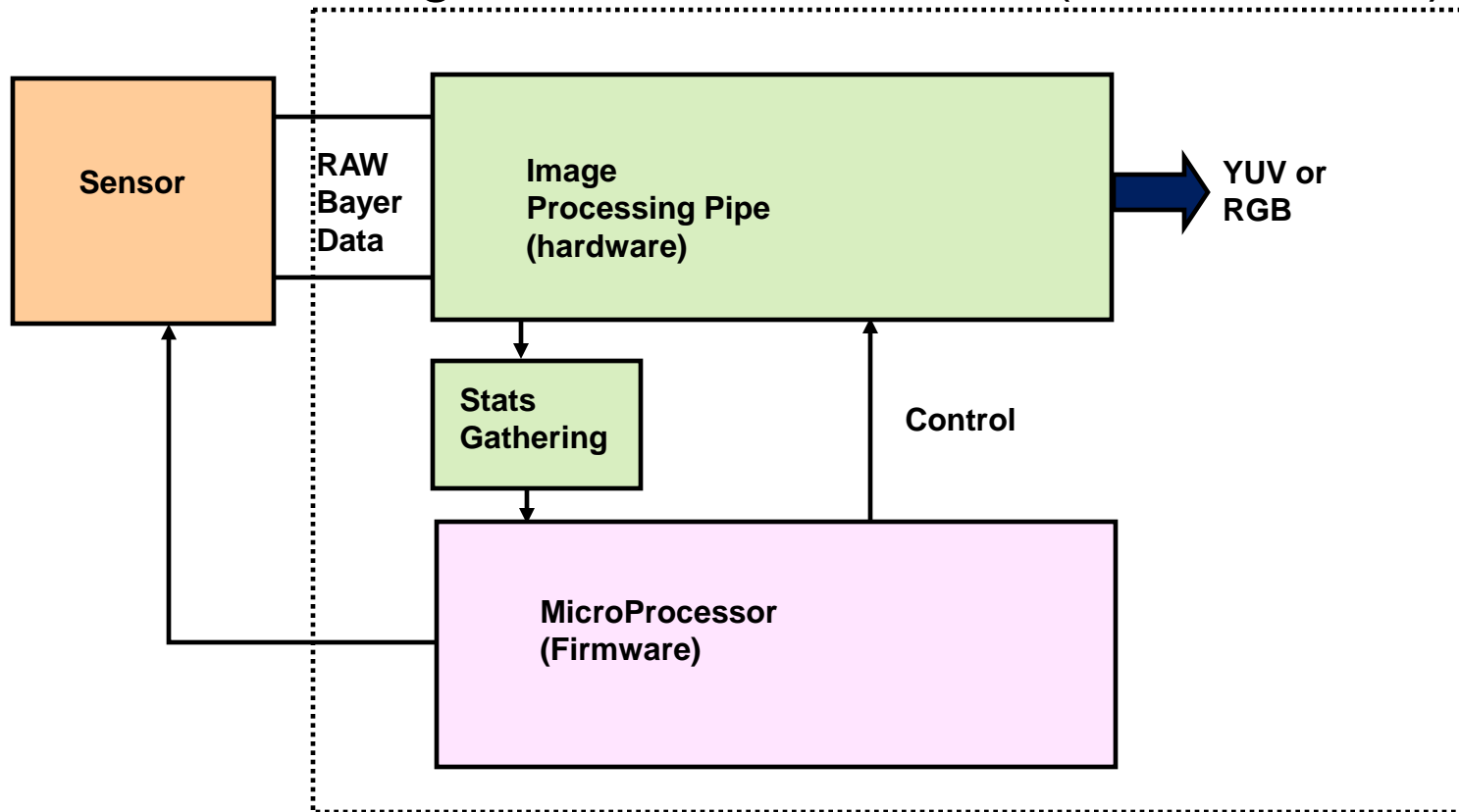
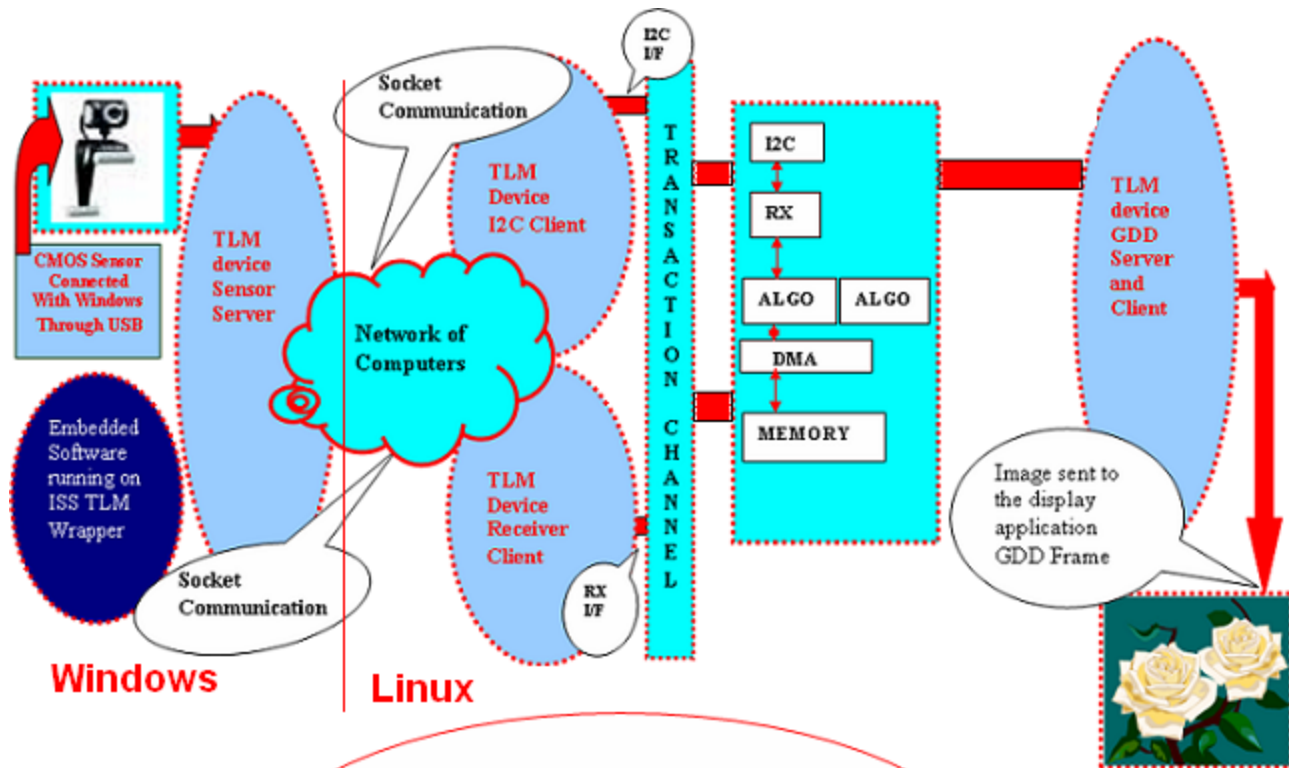


Image Signal Processor TLM Platform



Windows

Linux

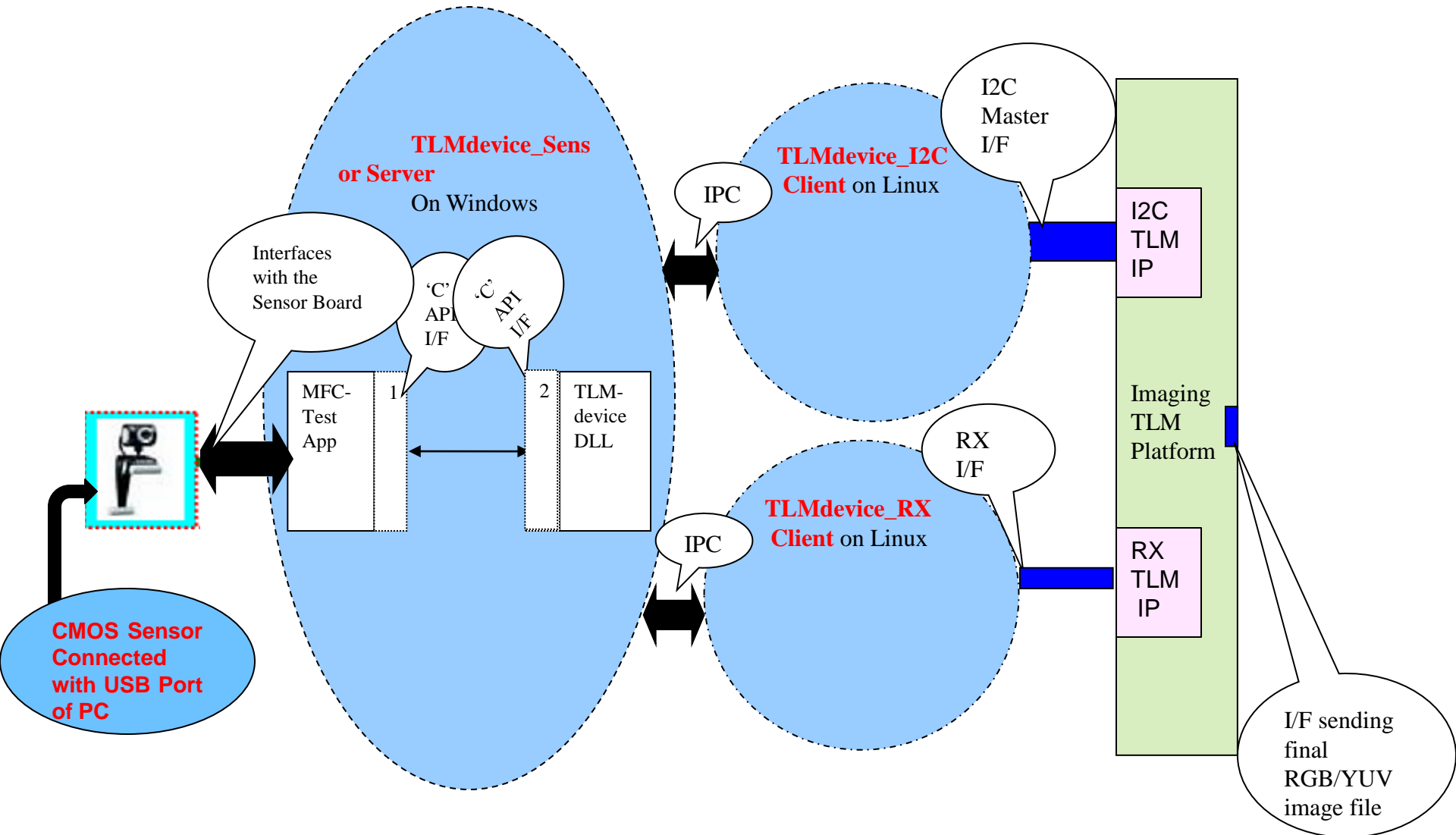
I2C- Inter Integrated Circuit Protocol
 RX- SMIA Receiver
 ALGO- Image Processing Algos
 GDD- Graphical Display Debugger
 eSW- Embedded Software
 ISS- Instruction Set Simulator

What is TLMdevice?

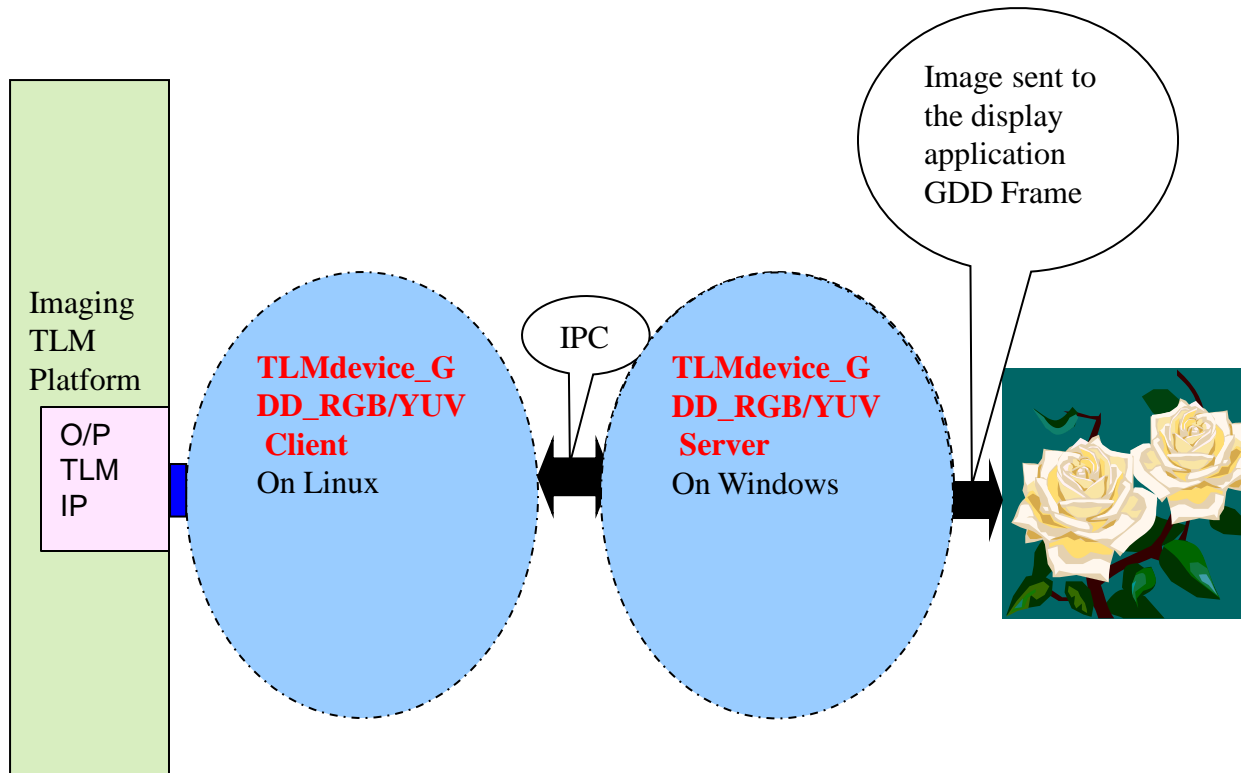


- ✓ *Way to Connect TLM Simulations with real hardware devices like UART, Display and Sensors.*
- ✓ *Set Of Libraries.*
- ✓ *Server-Client Methodology.*
- ✓ *Connection is based on socket communication.*
- ✓ *TLMdevice servers can be located anywhere on the network.*
- ✓ *Drivers are needed to configure sensor, capture the image from sensor and provide it to the SystemC TLM model.*
- ✓ *Data can be easily sent and received to/from during TLM simulation run.*
- ✓ *The only tools required to develop such TLM IPs are the free-of-charge open source SystemC 2.0 kernel, C++, GNU compiler & gdb debugger.*

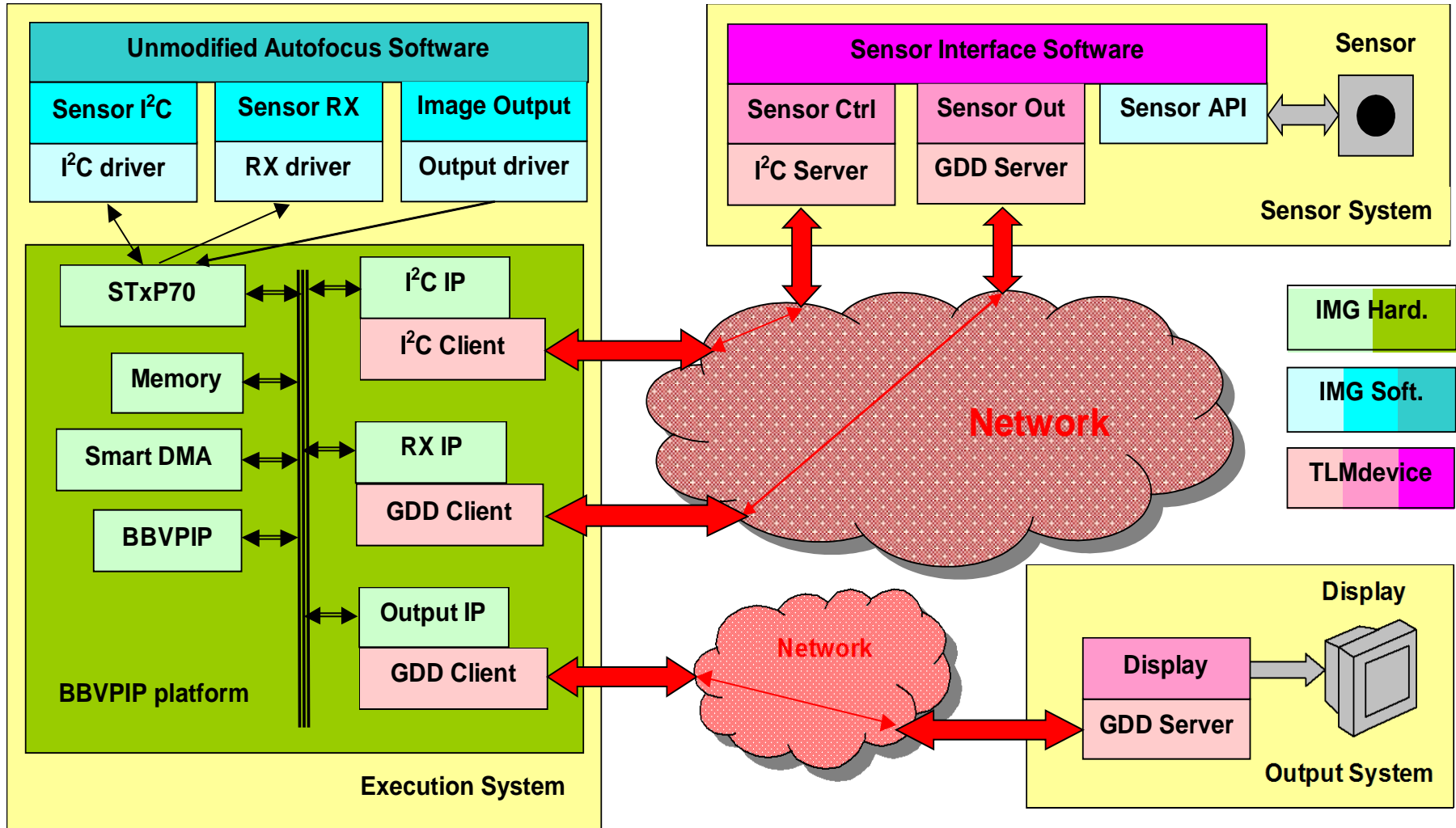
Dataflow of the platform



Dataflow of the platform



TLMdevice demonstrator



- ✓ In our Imaging Framework *TLM Models were interfaced with the SMIA compliant CMOS sensor using USB interface.*
- ✓ *TLM Model was able to process live streamed images from sensor.*
- ✓ *Firmware team appreciated this virtual platform because of its integration with real CMOS sensor and speed.*

Results & Conclusions

- ✓ Significant Time Gain in Product Tape-out.
- ✓ Successfully validated firmware algorithms like auto white balance, auto exposure with real sensor streamed images much before availability of chip.
- ✓ Up-to 2 fps frame-rate achieved.
- ✓ Relying on TLMdevice server-client approach, enables servers to be located anywhere on the network.
- ✓ Easy Integration of ISS debugger made debugging easy and powerful.

Conclusion

SystemC Transaction level models play a key role in different phases of SOC design cycle like architecture models, golden reference models for functional verification, early availability to act as Virtual Prototype for image quality analysis and close loop validations.

Thanks



Mamta CHALANA

(mamta.chalana@st.com)

Tech Leader

ST Microelectronics Pvt. Ltd

Bangalore

