Continental
The Future in Motion

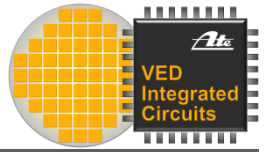
Mastering Unexpected Situations Safely

SensePlanAct

Using SystemC Models for pre-silicon development of an ATE Test Suite

COSIDE® User Group Meeting 2015

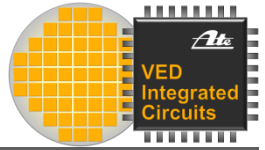
Agenda



1. Continental Business Unit Vehicle Dynamics
2. Motivation
3. System to be Modelled
4. Results & Conclusion

Continental Corporation

Five Strong Divisions



Chassis & Safety	Powertrain	Interior	Tires	ContiTech
Vehicle Dynamics	Engine Systems	Instrumentation & Driver HMI	PLT, Original Equipment	Air Spring Systems
Hydraulic Brake Systems	Transmission	Infotainment & Connectivity	PLT, Repl. Business, EMEA	Benecke-Kaliko Group
Passive Safety & Sensorics	Hybrid Electric Vehicle	Intelligent Transportation Systems	PLT, Repl. Business, The Americas	Compounding Technology
Advanced Driver Assistance Systems (ADAS)	Sensors & Actuators	Body & Security	PLT, Repl. Business, Asia Pacific	Conveyor Belt Group
	Fuel & Exhaust Management	Commercial Vehicles & Aftermarket	Commercial Vehicle Tires	Elastomer Coatings
			Two Wheel Tires	Fluid Technology
				Power Transmission Group
				Vibration Control

PLT – Passenger and Light Truck Tires

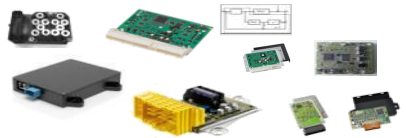
The Basics

If a car assists you or drives you automatically, it has to …

VED Integrated Circuits

Sense …sense its environment and vehicle´s current state...

Plan …plan its actions...



Act ...act using the car´s actuators and control systems.

Chassis & Safety Division

Business Units

Vehicle Dynamics

- Hydraulic Electronic Control Units (HECU)
  - ABS
  - ESC
- Software functions
  - Traction Control
  - Adaptive cruise control
  - Regenerative brake system
  - Active front steering
  - Hill start assist
  - Hydraulic brake assist
  - Trailer stability assist
- Chassis electronics
- Suspension systems

Hydraulic Brake Systems

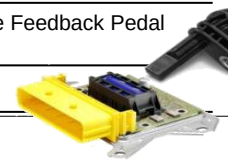
- Calipers
- Drum brakes
- Brake hoses
- Boosters
- Tandem master cylinders
- Electric parking brakes
- Pedal modules
- Brake pressure regulators
- Washer systems

Passive Safety & Sensorics

- Integrated vehicle safety development, safety testing & validation
- Airbag control units / safety (domain) control units
- Crash sensors
- Inertial measurement units
- Chassis and driver intention sensors
- Battery and energy monitoring sensors
- Electronic components (1st tier customer)
- Wheel, engine and transmission speed sensors
- Accelerator Force Feedback Pedal (AFFP®)
- V2X systems

Advanced Driver Assistance Systems

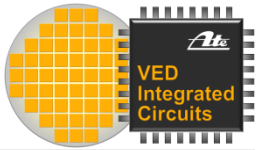
- Functions
  - Adaptive cruise control
  - Emergency brake assist
  - Lane departure warning
  - Lane keeping support
  - Blind spot detection
  - Traffic sign assist
  - Intelligent head lamp control
  - Rear cross traffic alert
  - Surround View
- Sensors
  - Radar
  - Camera
  - Lidar



Components of a Hydraulic Electronic Control Unit

- Motor
- Valve block
- Electronic Control Unit
  - Microcontroller
  - Mixed-Signal IC (PCU)

Agenda



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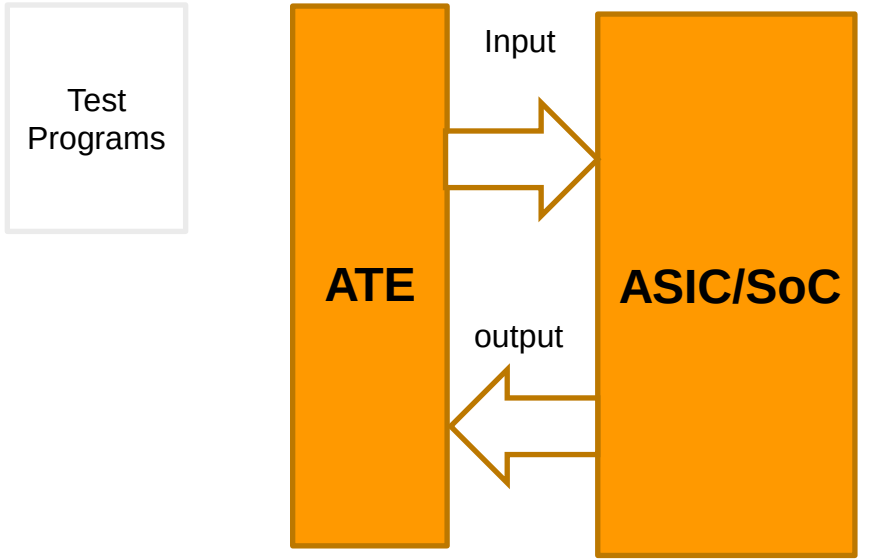
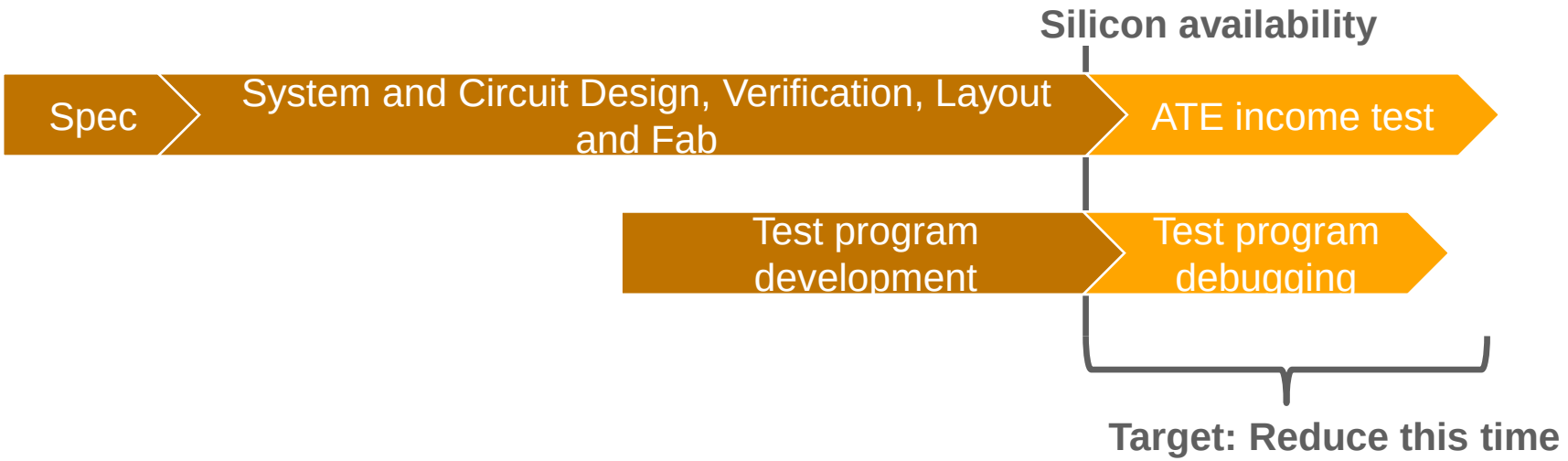
Automated Test Equipment

- First mixed-signal IC samples have to run through a series of tests to show that they meet the requirements.
- These tests are performed with the help of an Automated Test Equipment (ATE)
- An ATE system contains instruments that can drive or measure the individual pins of the IC under test
- How to operate these instruments is controlled by test programs which in our case are written in C language



Bottleneck: Time for Test Program Development



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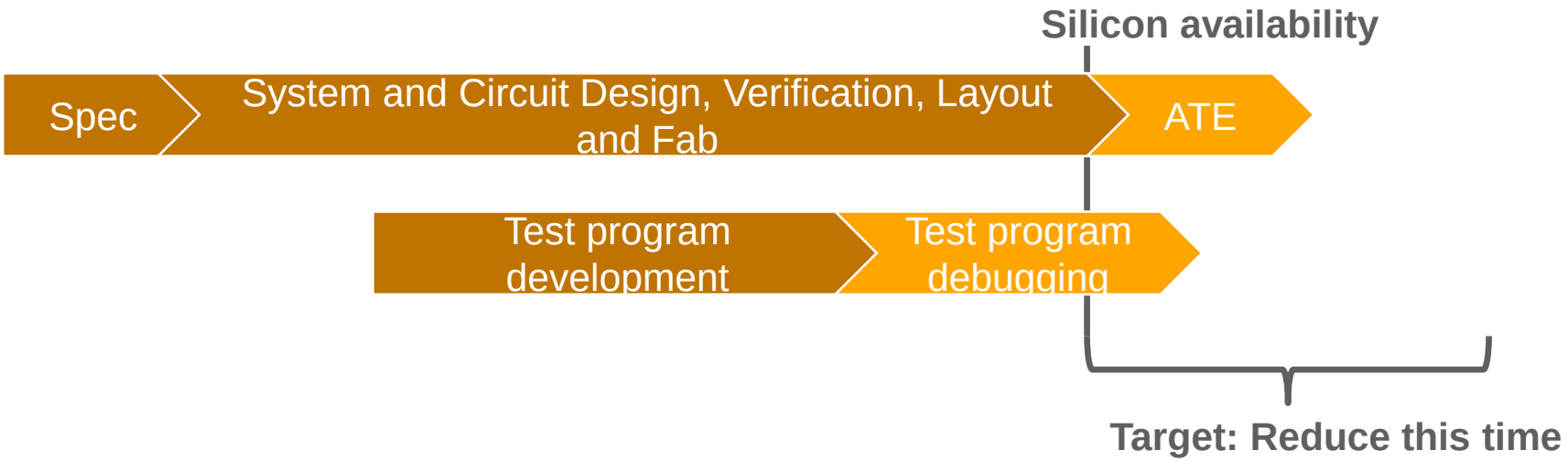

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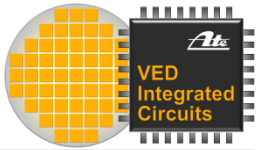

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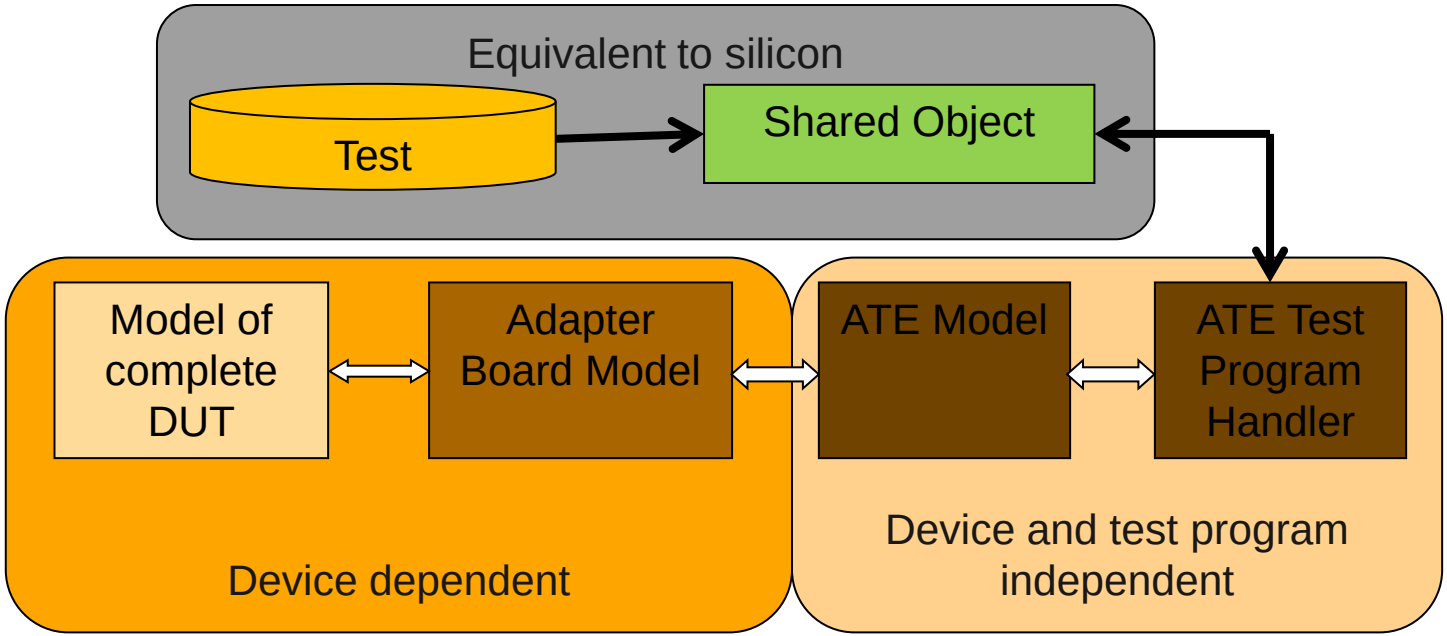
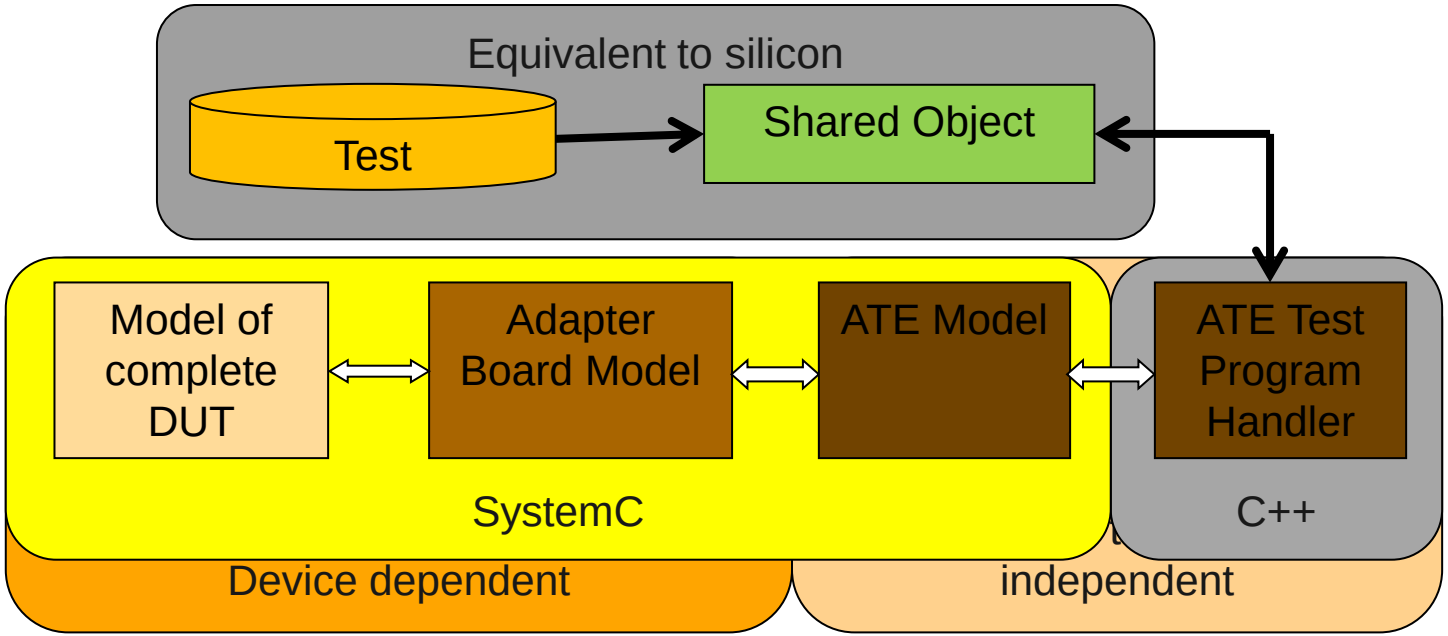
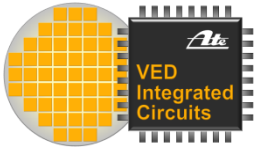
VirtualATE model



VirtualATE model



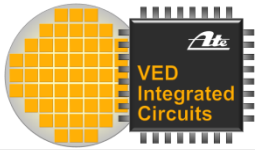
Device dependent models



- Device Under Test
  - Hierarchical model of complete IC
- Adapter board
  - Connection between ATE model and DUT model
  - Conversion of ATE model data types (real) to DUT data types (e.g. electrical, logic)
  - ~ 1 module for each pin of DUT
  - External circuitry

Example for DUT

Agenda



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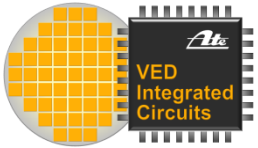
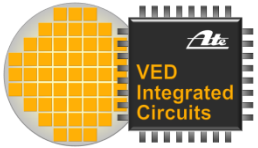
Results



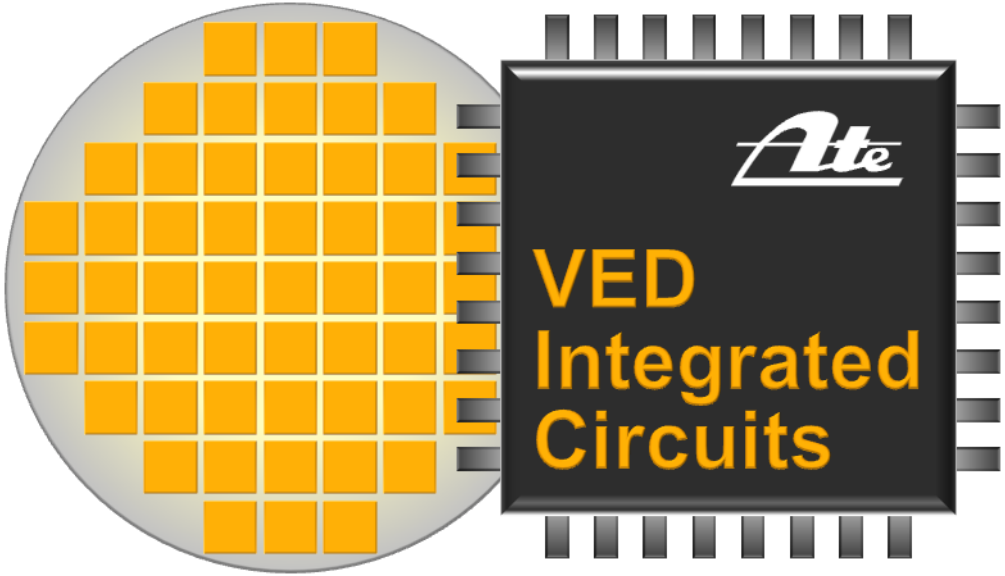
- Using VirtualATE the test program quality can be significantly increased before silicon availability
- Examples for errors detected:
  - Wrong address used in SPI transfer
  - Wrong range expected for result
  - Result stored in wrong location
  - Saturation of ADC not handled correctly
  - Endless loops due to not changing condition
  - Mixing voltages and currents
  - Missing initialization
  - Wrong ADC range

Conclusion



- VirtualATE helps to significantly improve the test program quality before silicon availability
- A model of board and DUT is required to achieve this benefit
- Complexity of board and DUT can only be handled with COSIDE® as IDE for SystemC-AMS

Thank you
for your attention!



ASIC solutions for Vehicle Dynamics

Safe and Dynamic Driving
towards Vision Zero

SensePlanAct
Chassis & Safety

Continental