NIDays

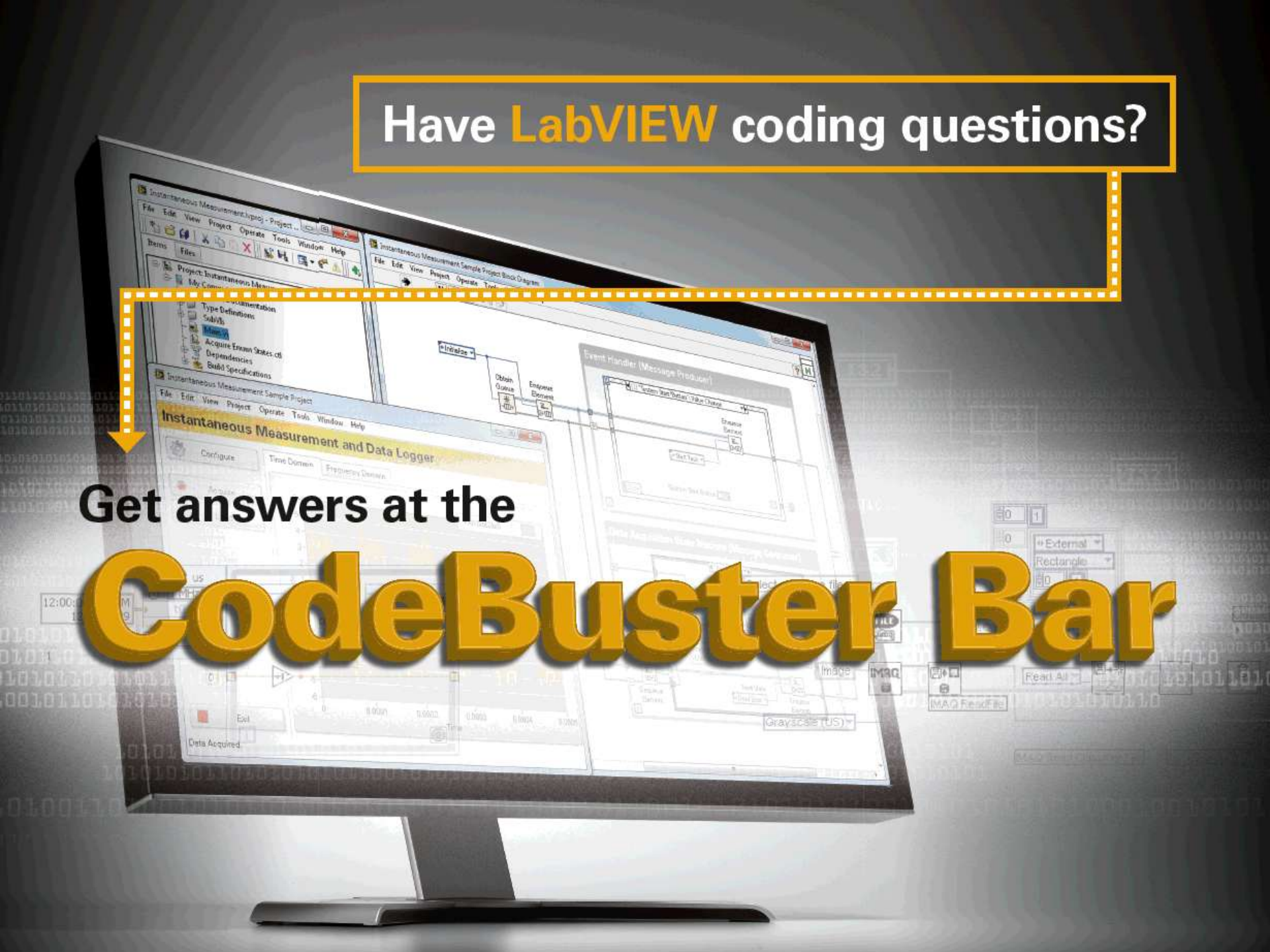
WORLDWIDE GRAPHICAL SYSTEM DESIGN

CONFERENCE

Welcome to NIDays

THE LabVIEW Conference

NATIONAL INSTRUMENTS


Have LabVIEW coding questions?
Get answers at the
CodeBuster Bar
Instantaneous Measurement and Data Logger

System Design for the 21st Century

Michael Neal

Senior Product Manager, LabVIEW

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Rapid Software Expansion

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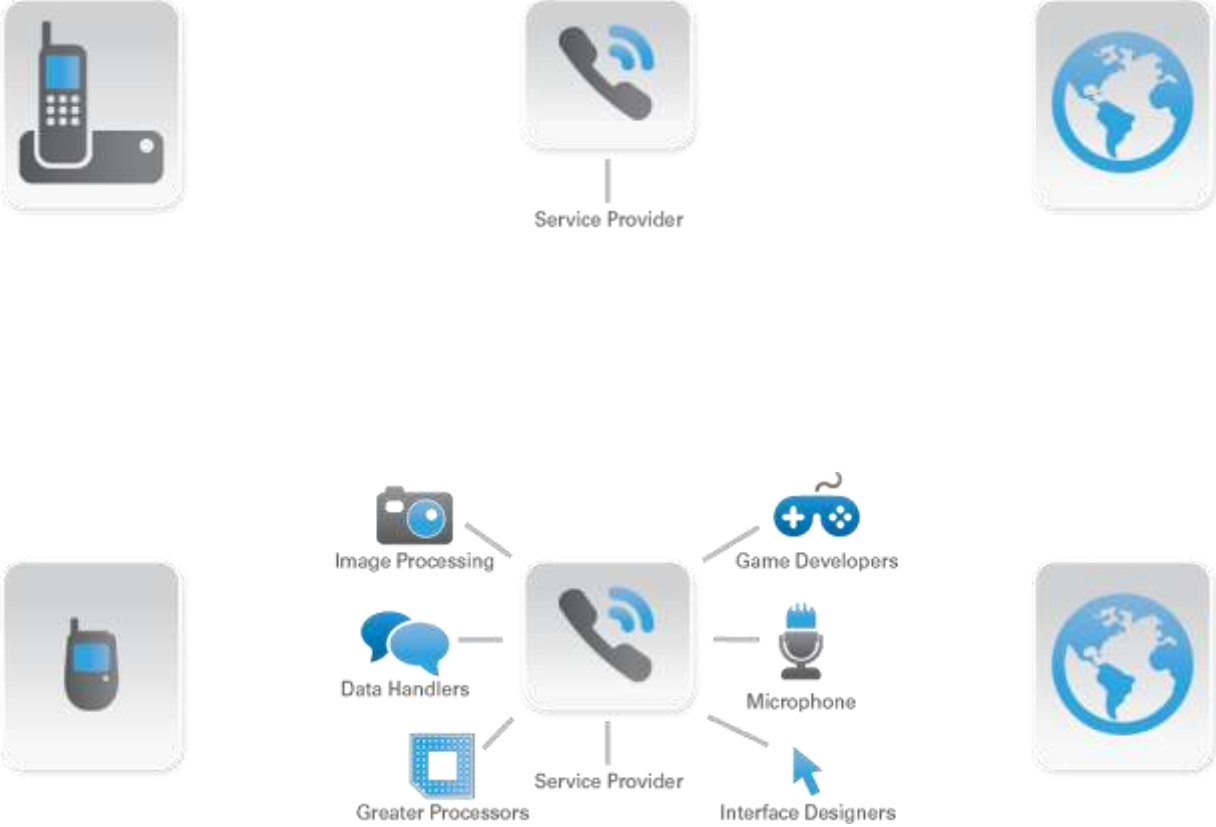
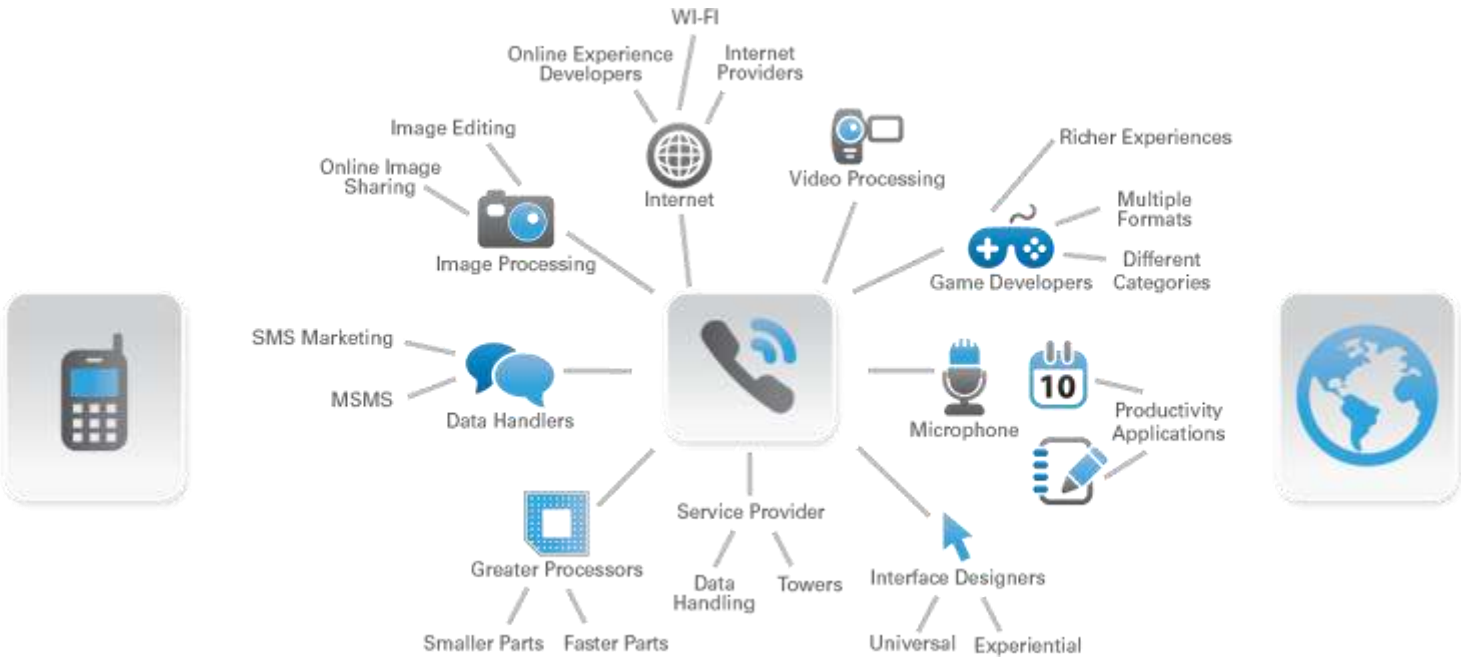
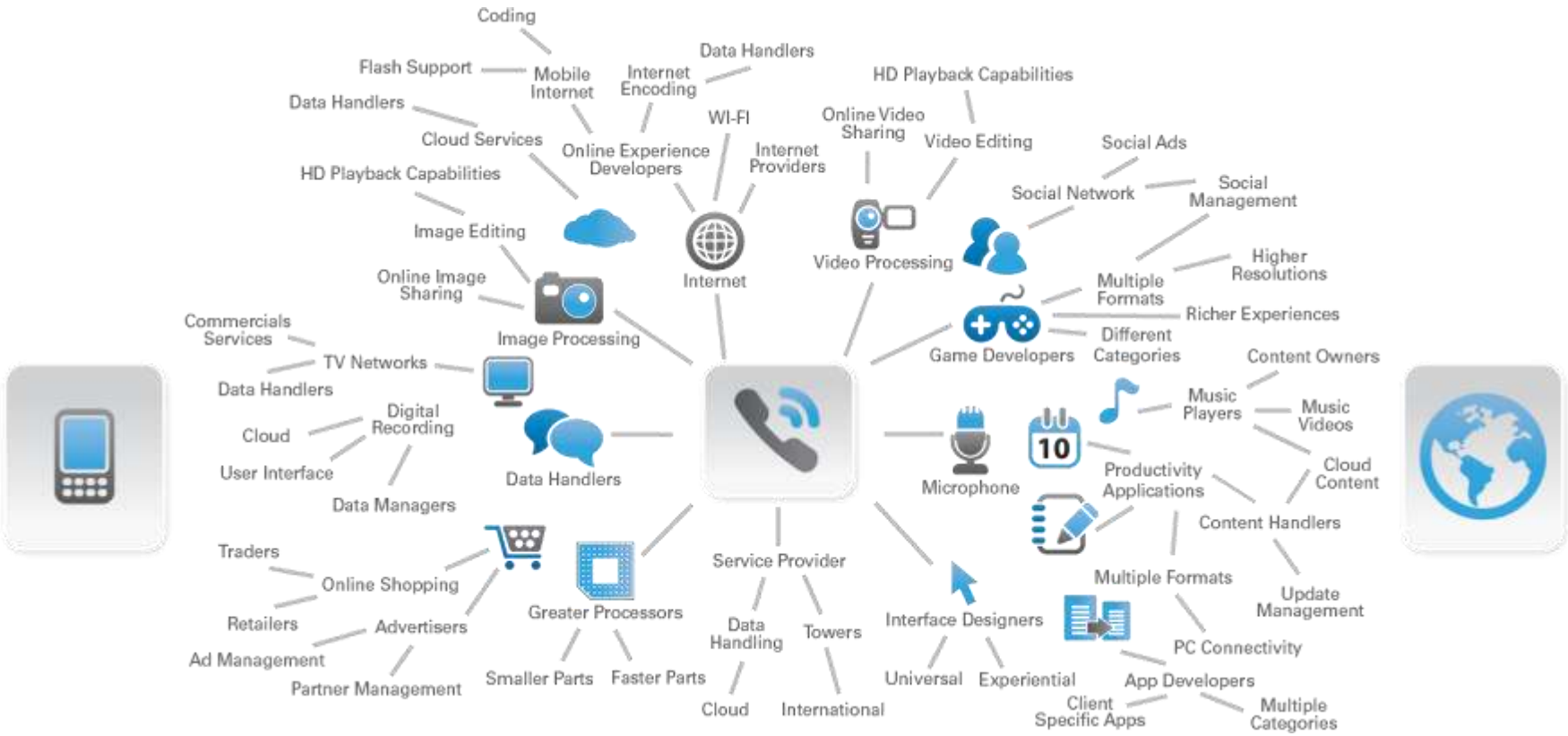
Escalating Complexity Over Time



Escalating Complexity Over Time



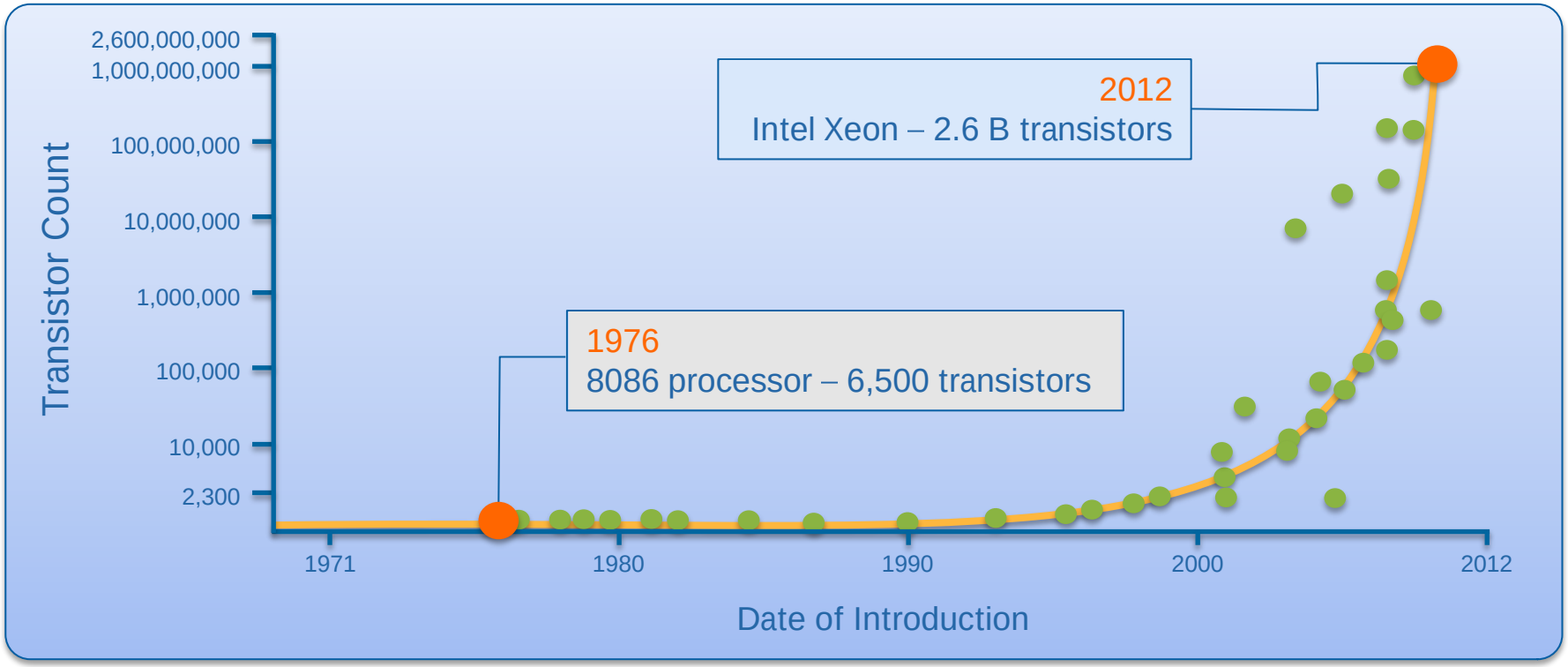
Escalating Complexity Over Time



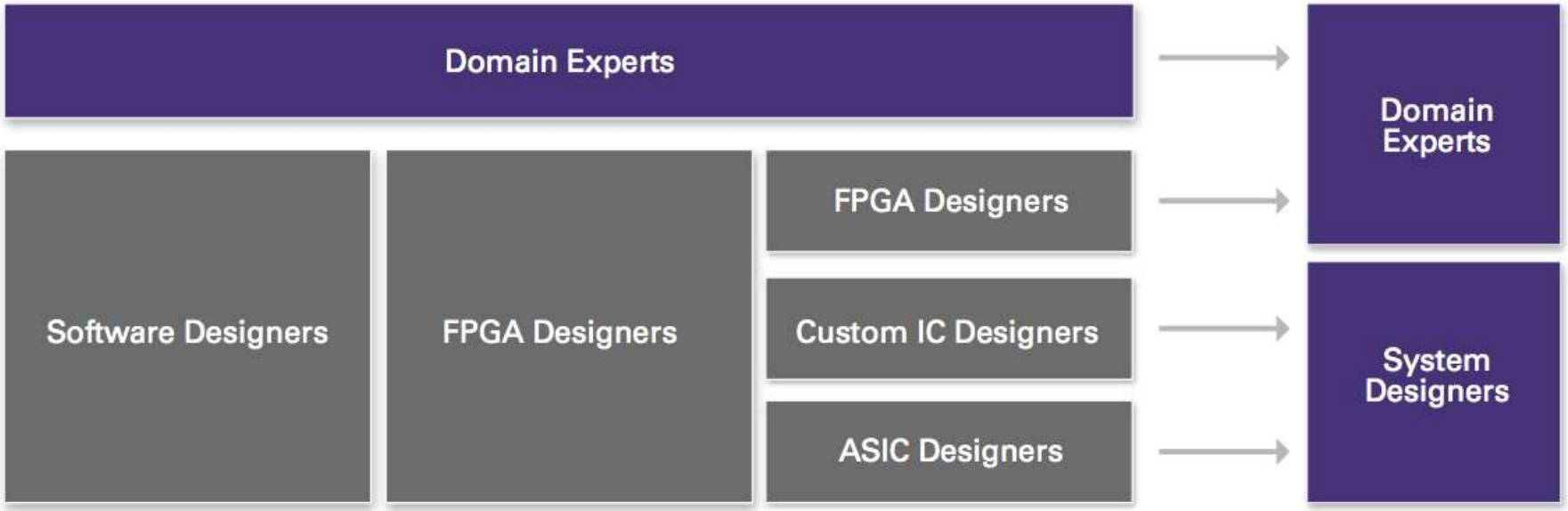
Evolution of Instrumentation

1968 1970 1972 1970 1980 1982 1984 1986 1988 1990 1996 1998 2000 2002 2004 2012 2012 2014 2016

Moore's Law


2,600,000,000
1,000,000,000
100,000,000
10,000,000
1,000,000
100,000
10,000
2,300
Transistor Count
2012
Intel Xeon – 2.6 B transistors
1976
8086 processor – 6,500 transistors
1971
1980
1990
2000
2012
Date of Introduction

Innovating More With Less



"Innovation initiatives that were once handled by dozens a decade ago are now run by only handfuls...less apparently enables more."

—Michael Schrage, Harvard Business Review Blog Network

Number of Engineers	Number of HDL Designers
>10 Million	~100,000

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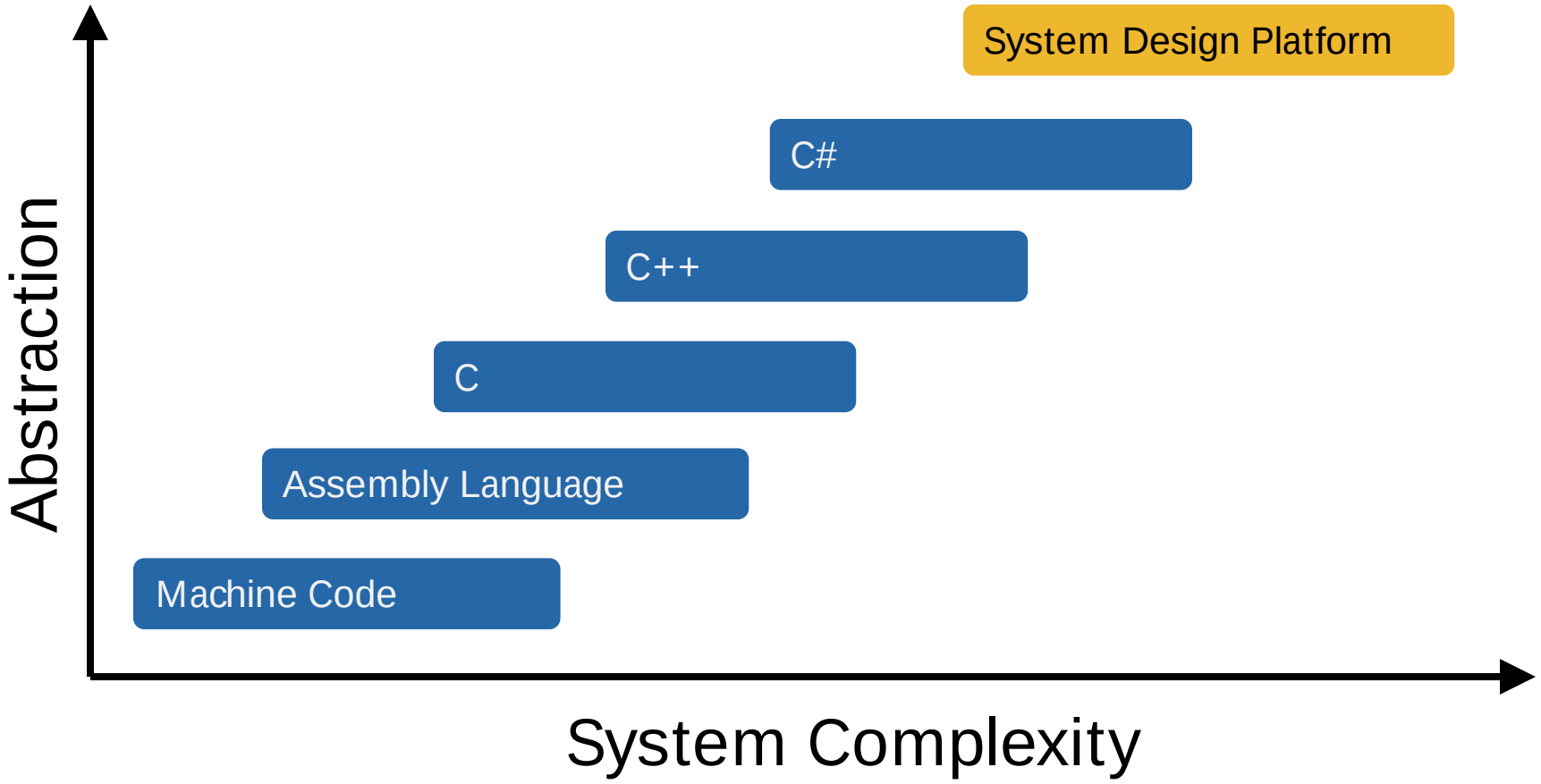
Scalable Software Abstraction

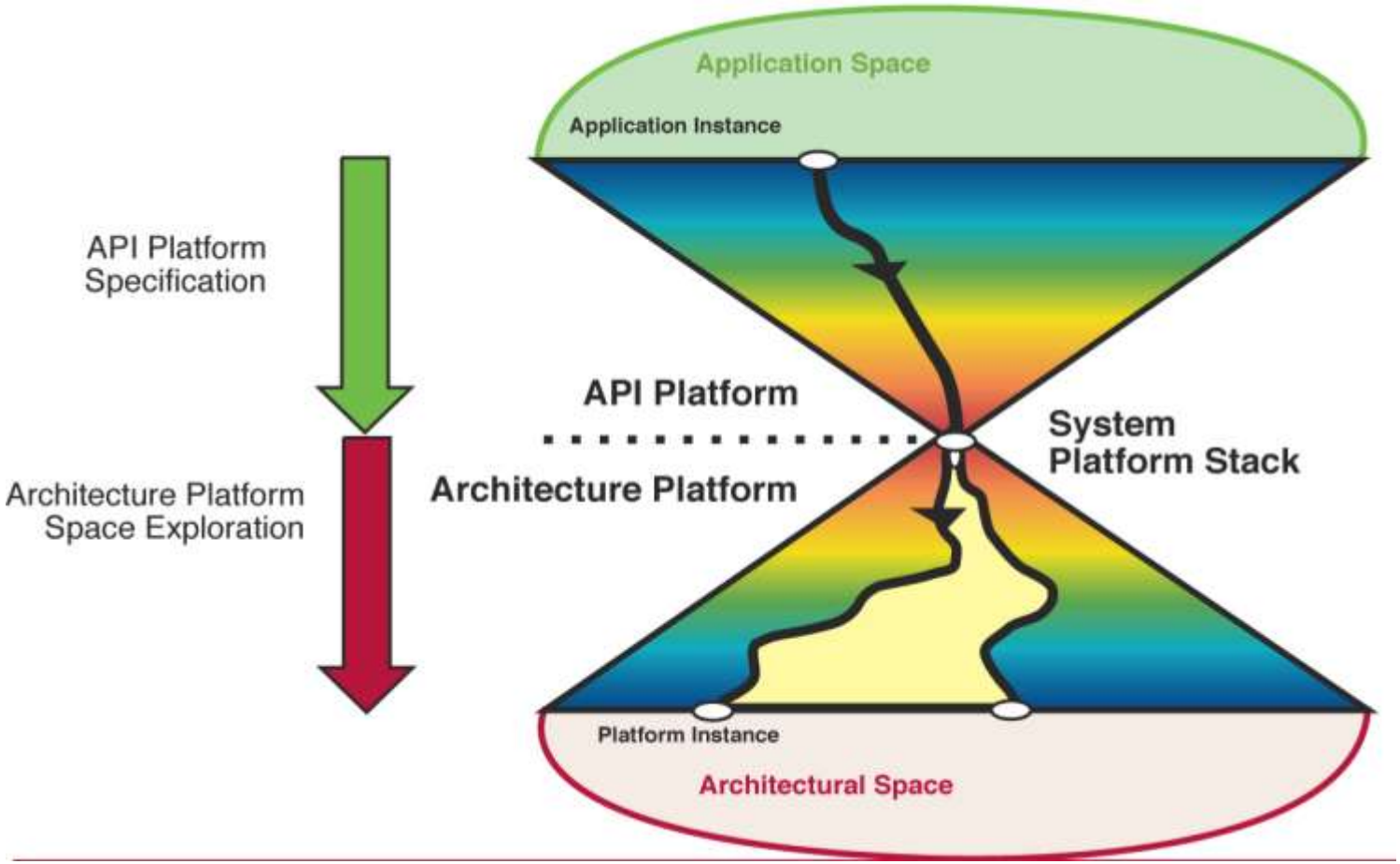


Academic Foundation to Strong Design

University of California Berkeley		National Instruments LabVIEW Dataflow
Berkeley SPICE1	1972	
	-	
EDA Design Tools – Synopsys (1986) • Cadence (1988)	1980	
	-	
Synchronous Dataflow	1986	LabVIEW 1.0
	-	
Ptolemy I	1990	LabVIEW Compiler
	-	
Boolean Dataflow • Multidimensional SDF	1993	
Integer Dataflow	1994	
Bounded Dynamic Dataflow	1995	
Ptolemy II	1996	
Hetereochronous Dataflow	1997	LabVIEW Multithreading
	1998	LabVIEW Real-Time Module
	-	
Giotto	2001	
	-	
	2003	LabVIEW FPGA Module
	2004	LabVIEW Control Design and Simulation Module
	-	
	2006	LEGO® MINDSTORMS® NXT-G
	2007	LabVIEW MathScript
	2008	LabVIEW Statechart Module • LEGO® Education WeDo™
PRET	2009	
	-	
	2011	LabVIEW FPGA IP Builder LabVIEW DSP Design Module

University of California Berkeley

A Platform-Based Design for System-On-Chip

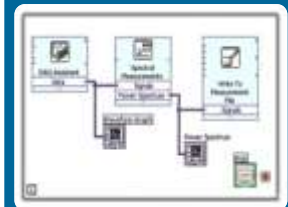


A. Sangiovanni-Vincentelli, UC Berkeley. Defining Platform Based Design. EEDesign, Feb 2002

Graphical System Design

A Platform-Based Approach for Measurement and Control

Data Flow

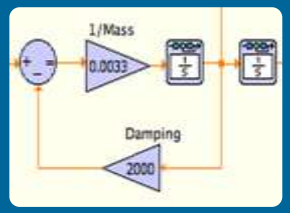


C/HDL Code

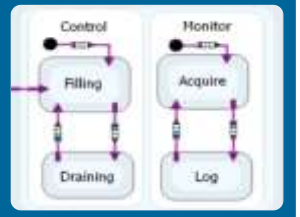
Textual Math

Multirate DSP

Simulation



State Chart



NATIONAL INSTRUMENTS

LabVIEW™

Personal Computers

PXI Systems

NI CompactRIO

NI Single-Board RIO

NI USRP

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Graphical System Design

A Platform-Based Approach for Measurement and Control

Test

Monitor

Embedded

Control

Mechatronics

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LabVIEW™

Desktops and PC-Based DAQ

PXI and Modular Instruments

NI CompactRIO and Custom Designs

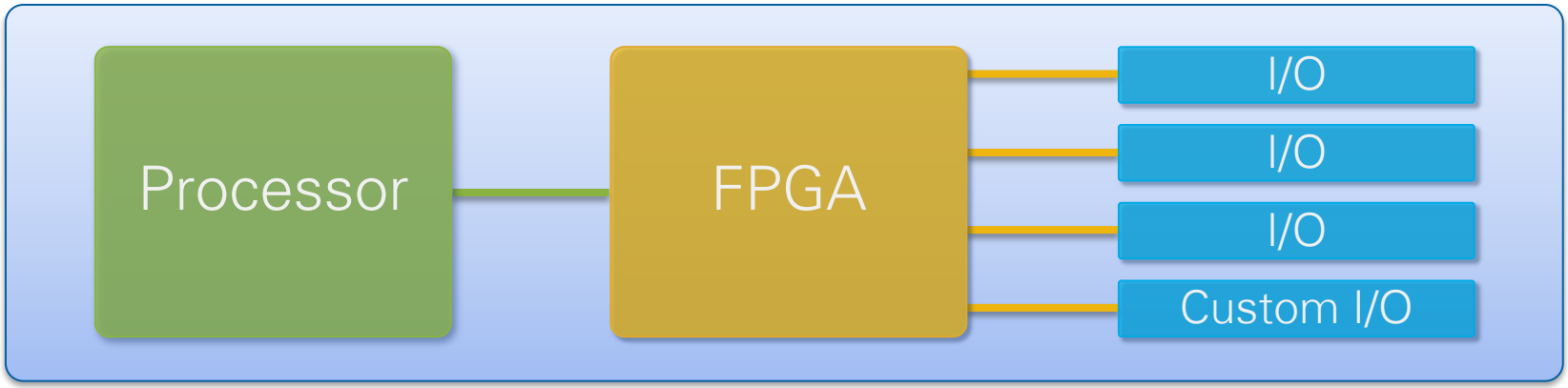
GPIB IEEE-488

ETHERNET

HI-SPEED CERTIFIED USB

Open Connectivity with 3rd Party I/O

LabVIEW Reconfigurable I/O (RIO) Architecture



NI CompactRIO and NI Single-Board RIO

LabVIEW RIO in PXI, PC
(NI R Series, NI FlexRIO)

Smaller Teams Get to Market Faster

Using the NI Graphical System Design Approach

1-ZZI-027
AUTOMOBILES
Impéria
LIEGE

Stand-Alone NI CompactDAQ

Embedded Measurements and Logging System

NI LabVIEW
System Design Software

NI DIAdem
Data Management

NI-DAQmx
Driver Software

External Devices
USB, Ethernet, Serial,

>50 I/O modules
Analog, digital, CAN, etc.

32 GB hard drive
Log for 360 hours*

Intel Core i7
Dual-Core processing

Multiple OS Options
Windows or Real-Time

High Data Throughput
Stream up to 30 MB/s to disk

Casper Klop

Technical Marketing

Wireless Everywhere

"the proliferation of mobile devices, including smart phones and other mobile devices, will continue to be the key growth driver into the foreseeable future."

- Jessy Cavazos, Industry Director, Frost and Sullivan

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“The best way to predict the future is to invent it.”

Alan Kay, software pioneer

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Introducing the PXIe-5644R

Worlds First Software Designed Instrument

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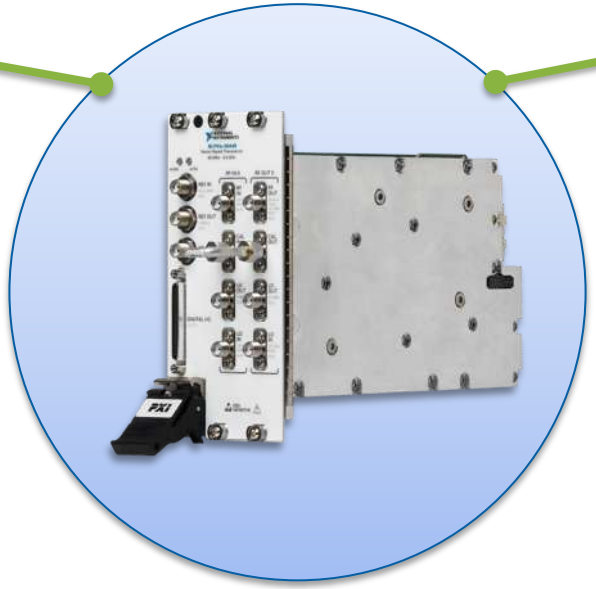
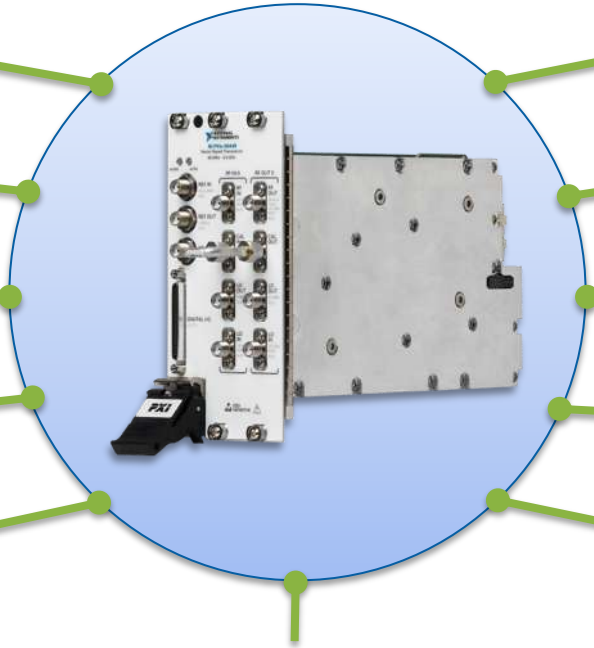
Software-Designed Instrumentation

Vector Signal Analyzer



Vector Signal Generator

Software-Designed Instrumentation



DUT Control

Protocol Aware ATE

Vector Signal Analyzer

Frequency Triggering

Test Sequencing

Power Level Servoing

Noise Correction

Software Defined Radio

Channel Emulation

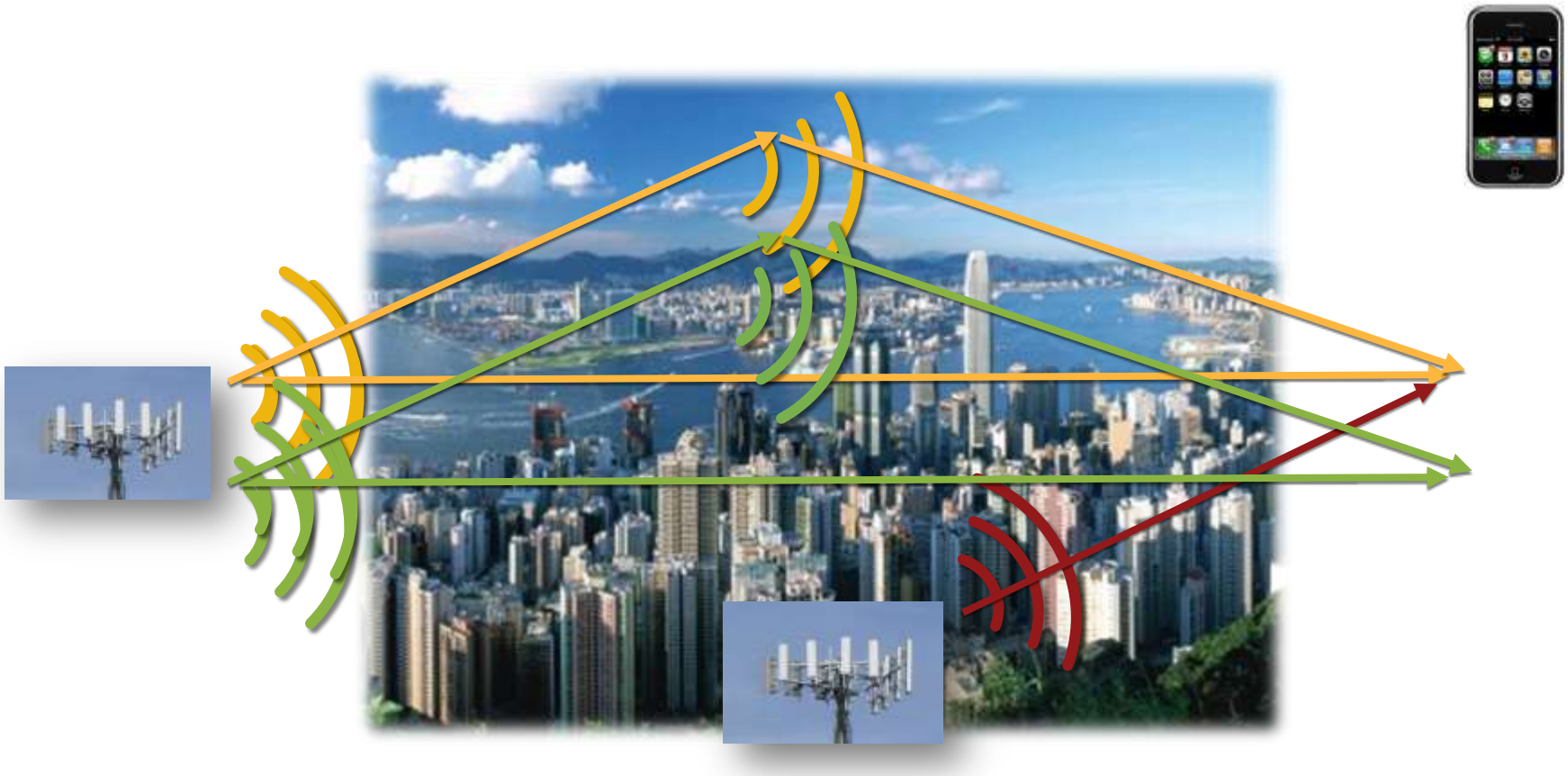
Vector Signal Generator

Frequency Domain Averaging

Remco Krul

Technical Marketing

Radio Propagation Environment



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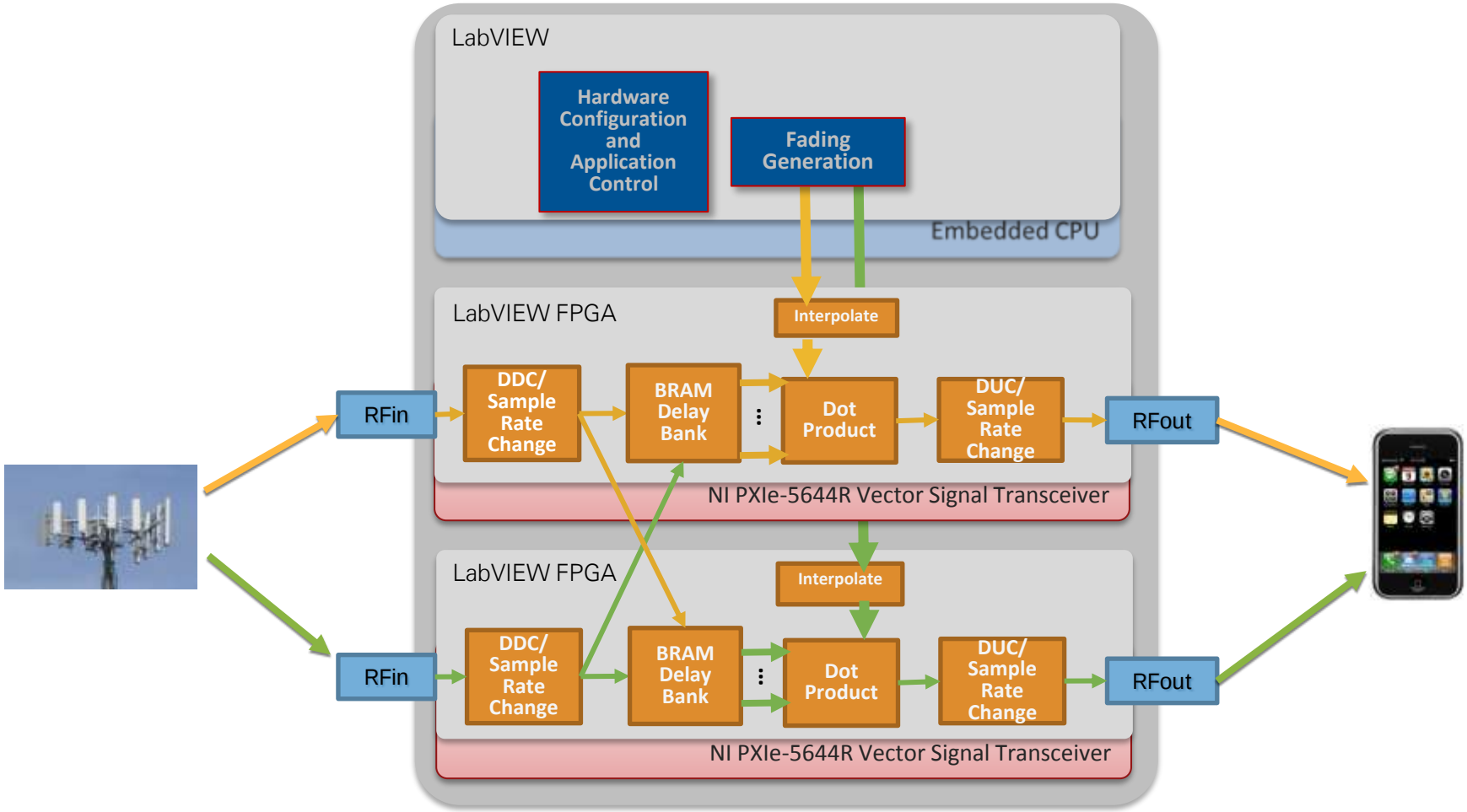
Real-Time MIMO Channel Emulation



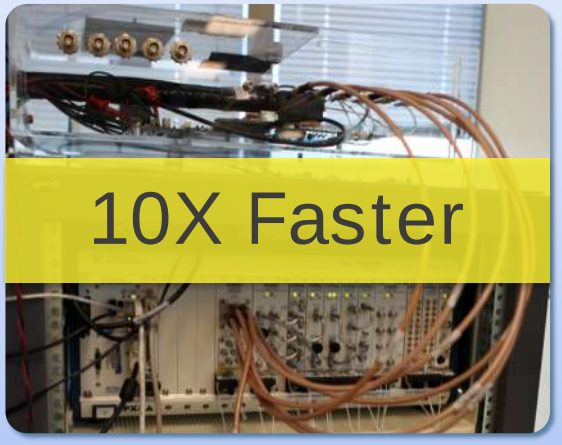
Qualcomm Atheros – Evolution of Instrumentation

EVM (dB) versus Average Output Power Chain

802.11a + b + g

Early 2000s
Traditional Rack and Stack

+ 802.11n



2007
NI PXI RF Instrumentation

+ 802.11ac

2012
NI Vector Signal Transceiver

Domain Experts from LEGO to Rocket Science

LEGO mindstorms education

NATIONAL INSTRUMENTS LabVIEW

SPACEX

Dragon Longitude
-124.7 deg
Dragon Altitude
1867.1
3191.56
29.5744
0.997393
26.2622
180.002
-6369.82
POWERED BY
NATIONAL INSTRUMENTS
LabVIEW