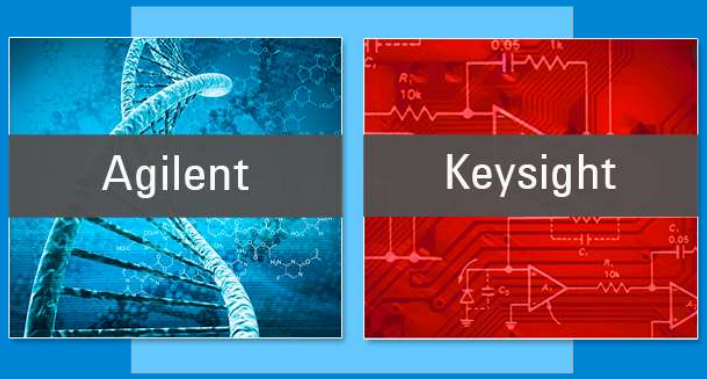
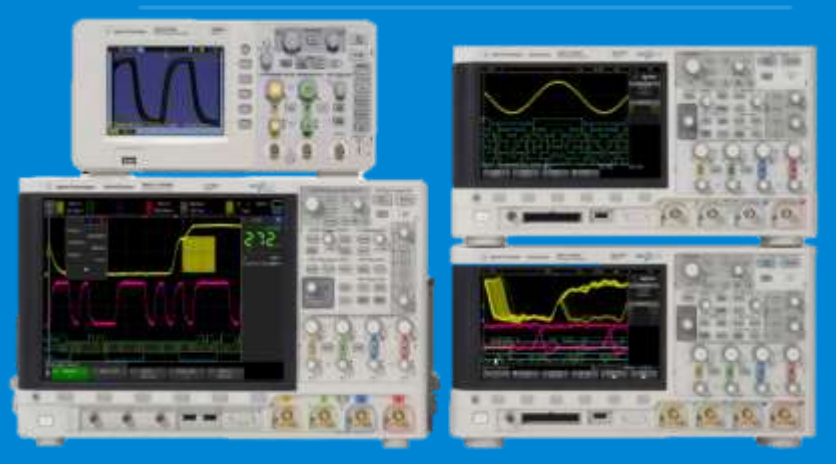
# Welcome to Advanced Troubleshooting with Oscilloscopes

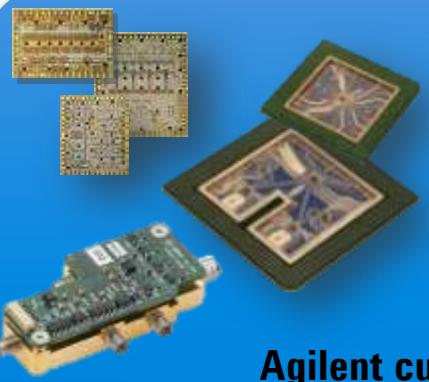


**Max Hoffee**
**Marketing/Training Specialist**

# Agilent Oscilloscope Portfolio

KEYSIGHT TECHNOLOGIES



DCA-X Sampling

90000 Q-Series

90000 X-Series

Agilent custom ASIC technology designed for market leading performance.

InfiniiVision Oscilloscopes

**Agilent custom ASIC technology designed for market leading value.**

90000 Series

U1600 Series

U2700 Series

1000 Series

2000 X-Series

3000 X-Series

4000 X-Series

6000L Series

9000 Series

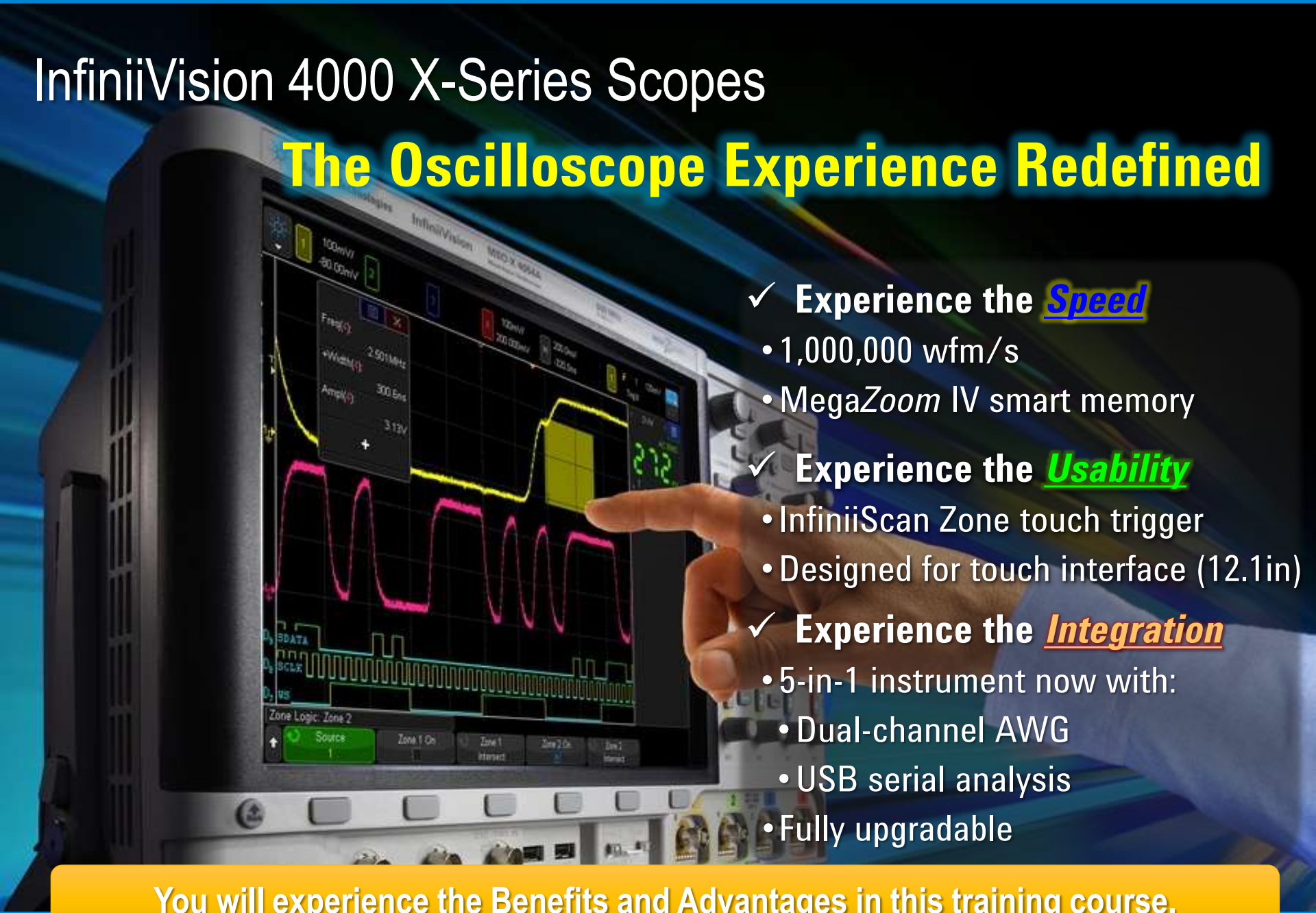
# InfiniiVision Oscilloscopes

KEYSIGHT TECHNOLOGIES


| | 2000 X-Series | 3000 X-Series | 4000 X-Series |
|---|---|---|---|
| **Bandwidth** | 70/100/200 MHz | 100/200/350/500M, 1 GHz | 200/350/500M, 1/1.5 GHz |
| **Sample rate** | 2 GSa/s | 4 GSa/s (5 GSa/s on 1GHz) | 5 GSa/s |
| **Memory depth** | 100 kpts std, 1Mpts option | 2 Mpts std, 4 Mpts option | 4 Mpts standard |
| **Channels** | 2 or 4 analog | 2 or 4 analog | 2 or 4 analog |
| **MSO** | + 8 digital | + 16 digital | + 16 digital |
| **Display** | 8.5" WVGA | 8.5" WVGA | 12.1" SVGA capacitive touch |
| **Update rate** | 50,000 wfm/s | 1,000,000 wfm/s | 1,000,000 wfm/s |
| **InfiniiScan Zone** | No | No | Standard |
| **WaveGen** | Option | Option | Option, Dual-Ch AWG |
| **DVM** | Option | Option | Option |
| **Mask test** | Option | Option | Option |
| **Segmented** | Option | Option | Standard |
| **Serial decode** | 5 Protocols | 9 Protocols | 11 Protocols, including USB |
| **Search & nav** | Serial only | Standard | Standard |
| **Power analysis** | No | Option | Option |
| **Advanced math** | No | Option | Standard |
| **HDTV video** | No | Option | Option |

# InfiniiVision 4000 X-Series Scopes

## The Oscilloscope Experience Redefined



- ✓ **Experience the *Speed***
  - 1,000,000 wfm/s
  - Mega*Zoom* IV smart memory
- ✓ **Experience the *Usability***
  - InfiniiScan Zone touch trigger
  - Designed for touch interface (12.1in)
- ✓ **Experience the *Integration***
  - 5-in-1 instrument now with:
    - Dual-channel AWG
    - USB serial analysis
  - Fully upgradable

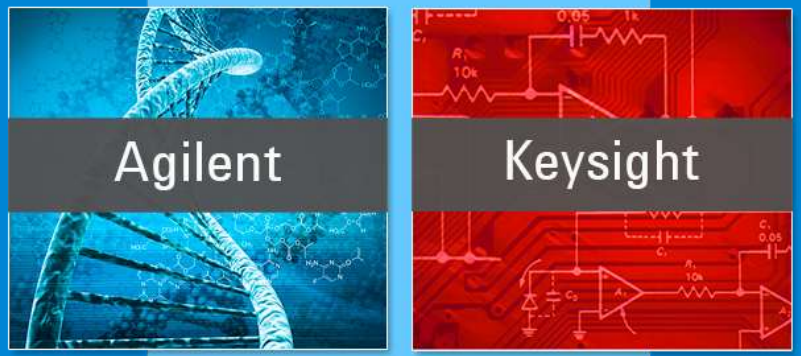
**You will experience the Benefits and Advantages in this training course.**

Agilent Technologies

# Advanced Troubleshooting with Oscilloscopes

*Agenda*

| Time | | What we'll cover |
|---|---|---|
| 10 | Lab #1 | GUI / front panel overview |
| 10 | Lab #2 | Finding rare glitches **Speed** |
| 20 | Lab #3 | Advanced triggering **Usability** |
| 20 | Lab #4 | Techniques to maximize memory |
| 20 | Lab #5 | Serial decode and trigger (USB) **Integration** |
| 10 | Lab #6 | Integration demos (sp) |
| 10 | | Wrap up and questions |



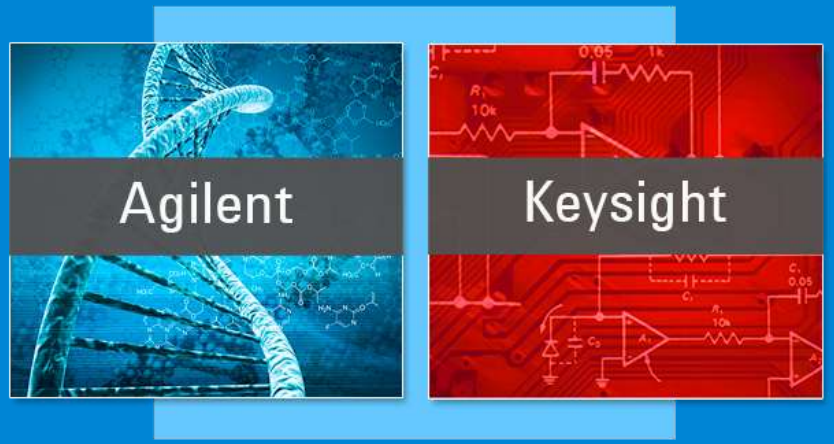

# Lab #1

GUI and Front Panel

# What Did we Learn?

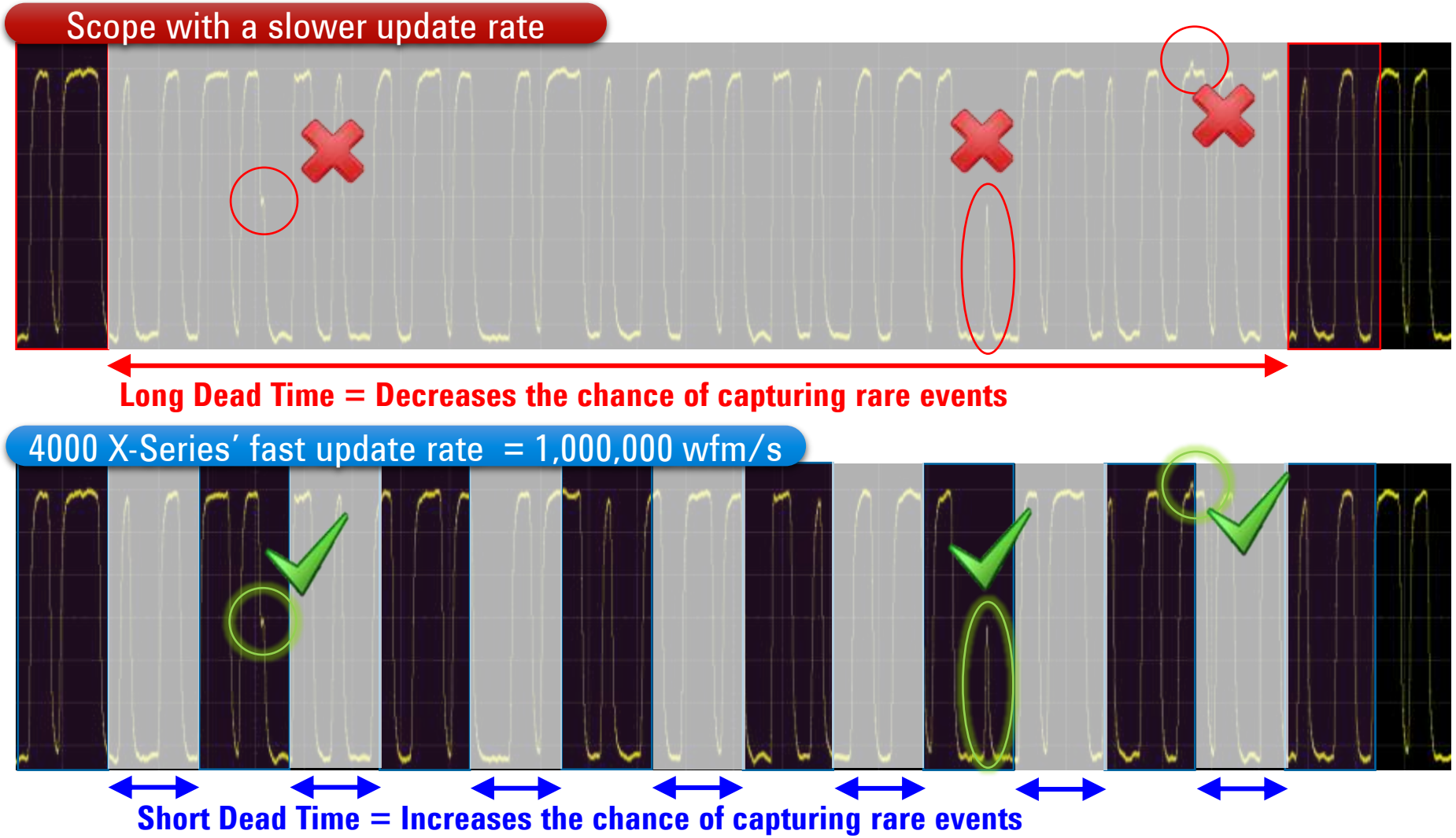
- The 4000 X-Series features the industry's only capacitive touchscreen
- The all new touch interface makes cursors, measurements, and scaling waveforms simpler
- On screen keyboards make entering specific values a breeze over using a rotary knob

# Lab #2

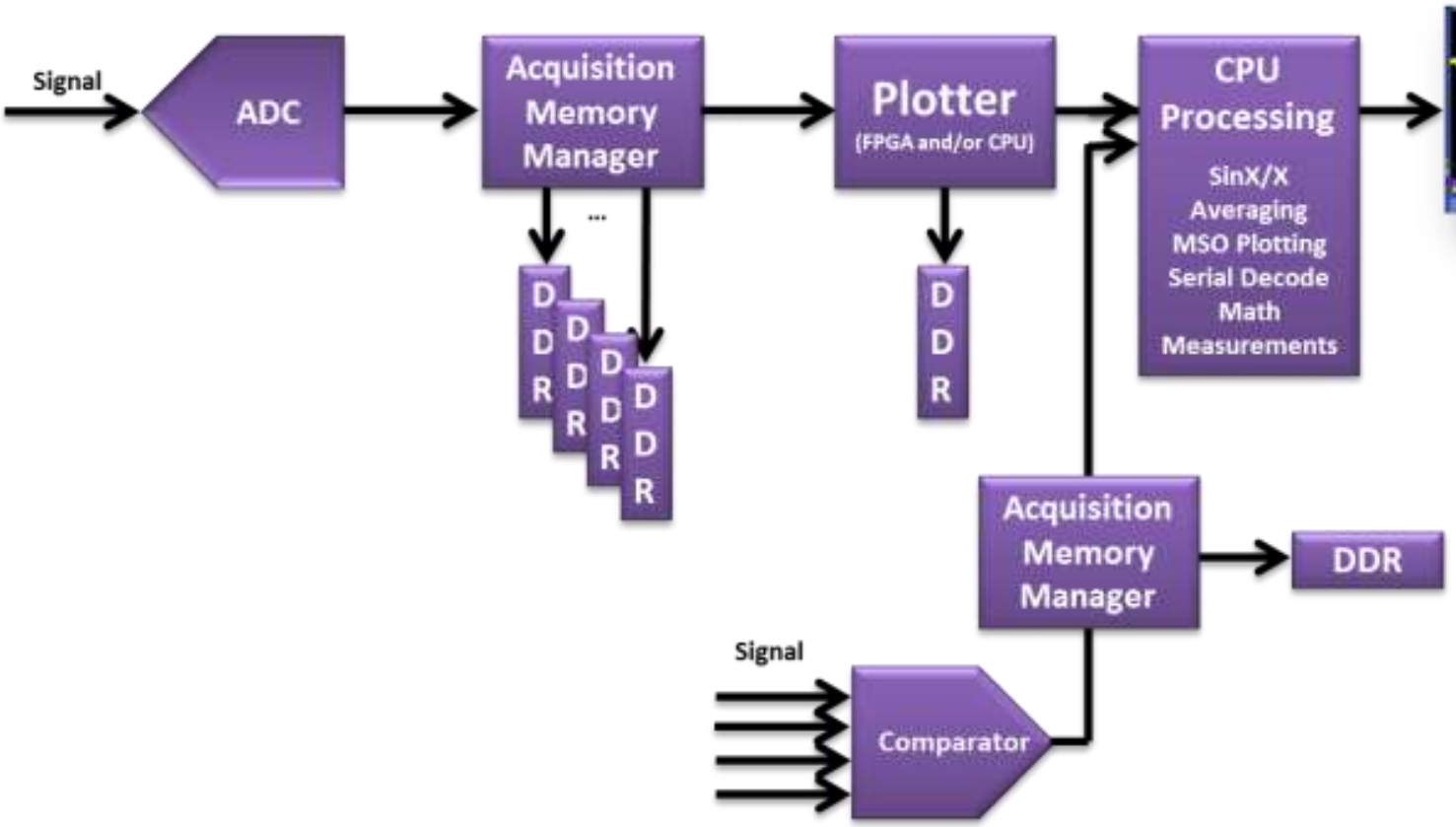



Finding Rare Glitches

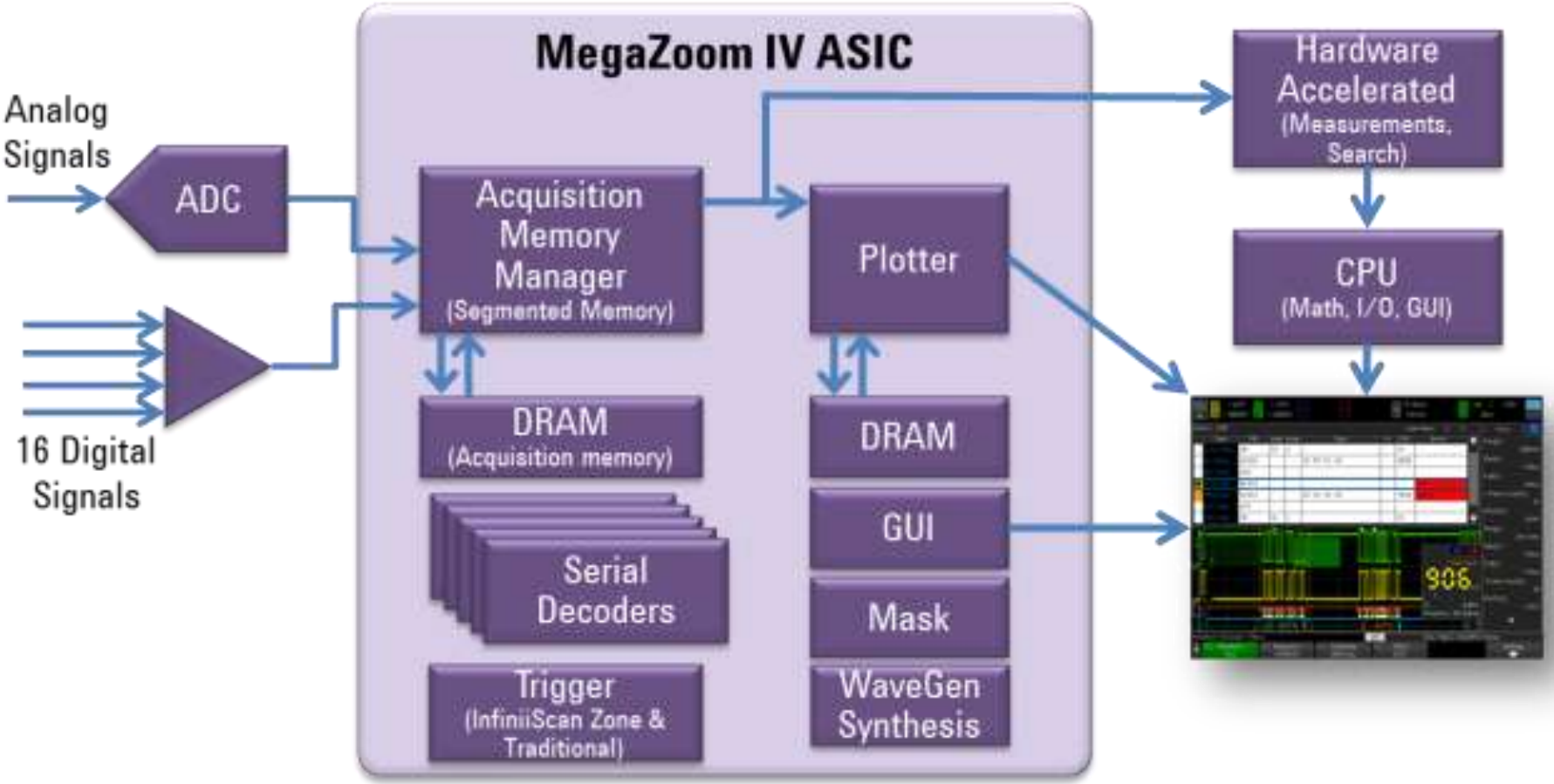
# Fast Update Rate = Short Dead Time (blind time)



# Traditional CPU Architecture

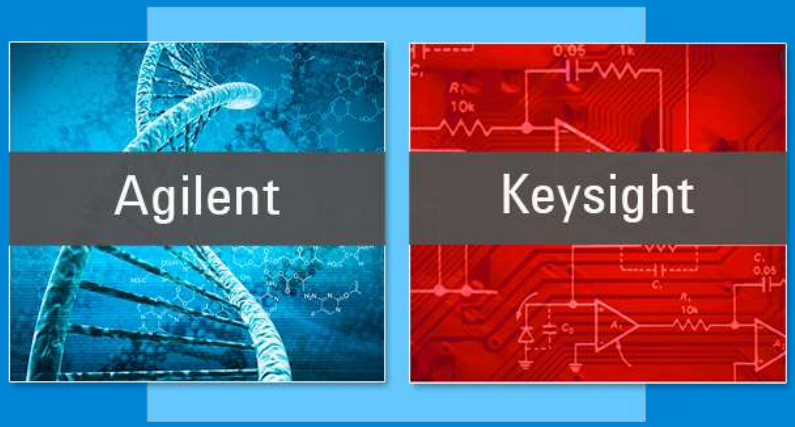


# Agilent's MegaZoom IV Architecture



# What did we learn?

- Fast update rate on an oscilloscope allows you to find problems faster and reduce time of debug.
- Agilent's hardware SoC is not dependent on CPU cycles and thus runs asynchronously from any CPU processes, keeping oscilloscope speed at a maximum, all the time.
- Tools such as infinite persistence and mask testing can help you characterize signal extremes, such as noise, and visualize rare events easier.
- **Visualization is the first step in the troubleshooting process.**

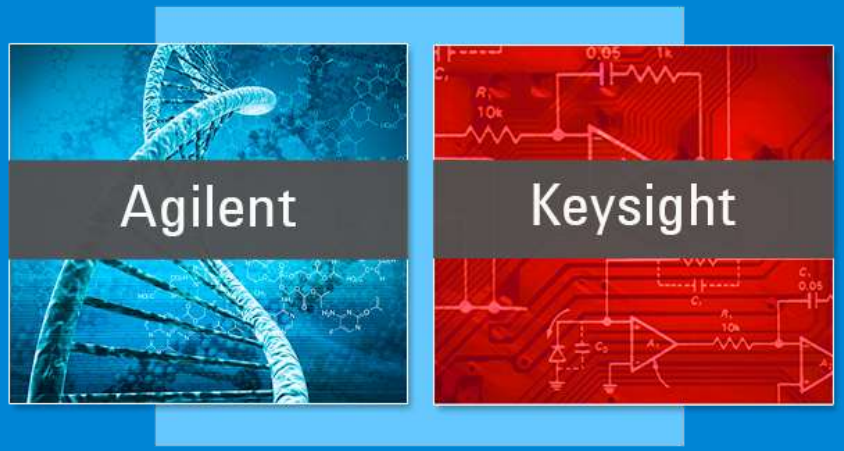



# Lab #3

Advanced Triggering

# What did we learn?

- Oscilloscopes offer a variety of hardware triggers. Some require more configuration than others.
- The 4000 X-Series offers standard zone qualification triggering.
- Every pixel on the screen is mapped into the MegaZoom IV chip. A hardware process can be used to qualify triggers up to 200,000 times per second.

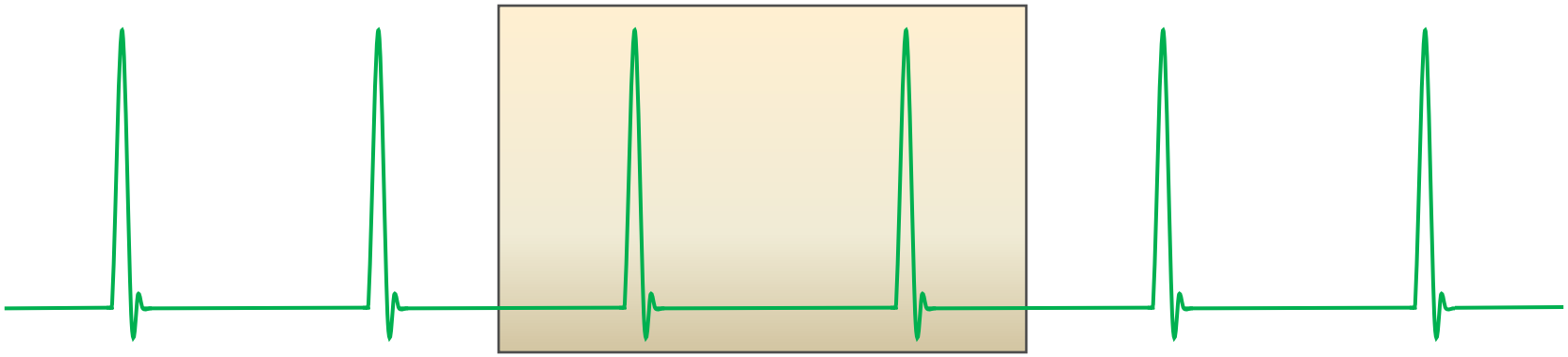



# Lab #4

Techniques to Maximize Memory

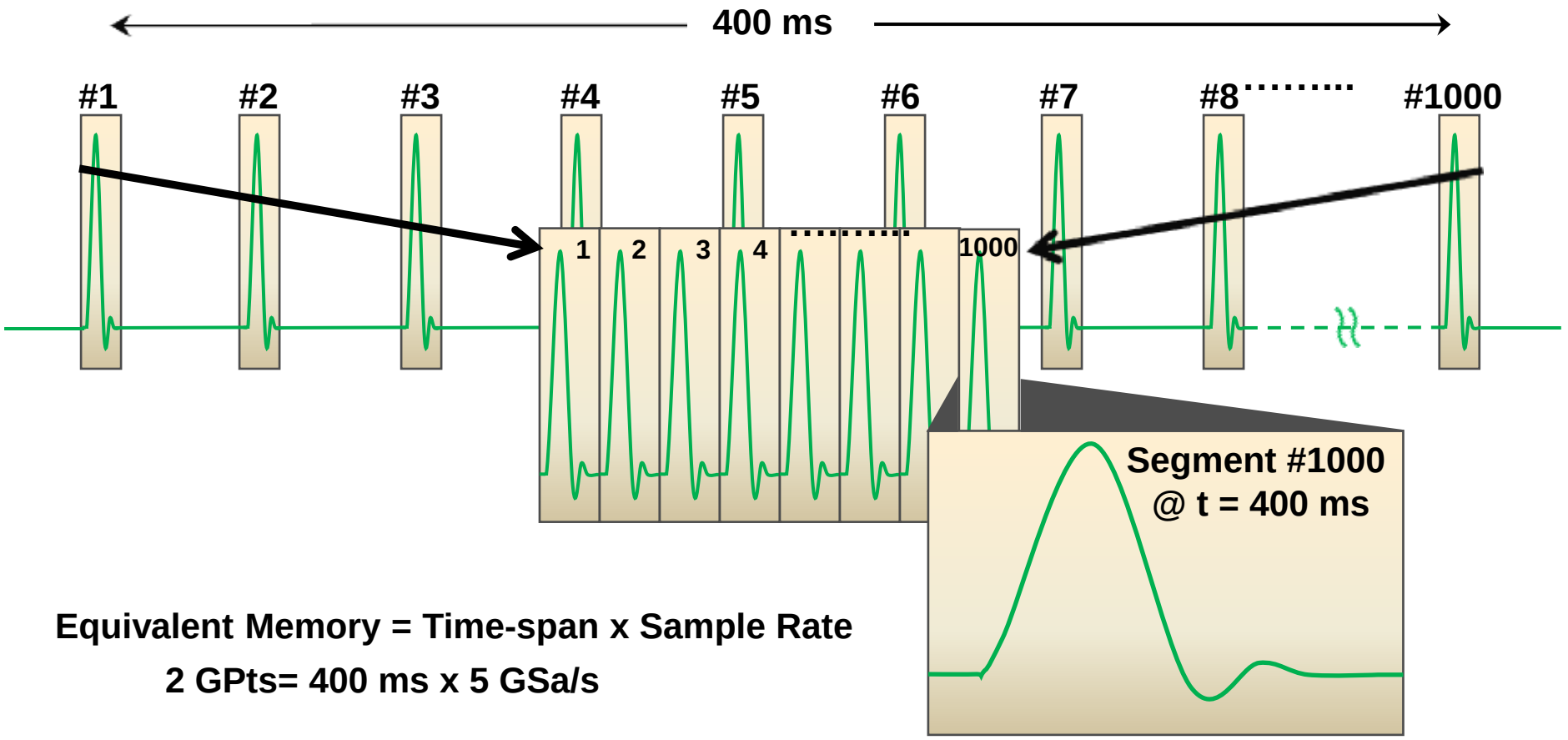
# Traditional Deep Memory Acquisition

**Acquisition Time = Memory Depth/Sample Rate**



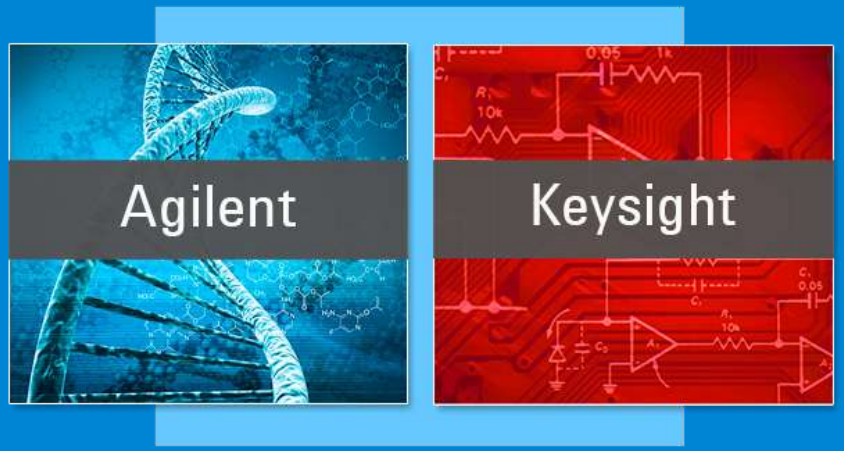
# Segmented Memory Acquisition

**Selectively captures more waveform data with precise time-stamps for each segment**




**Equivalent Memory = Time-span x Sample Rate**

**2 GPts= 400 ms x 5 GSa/s**



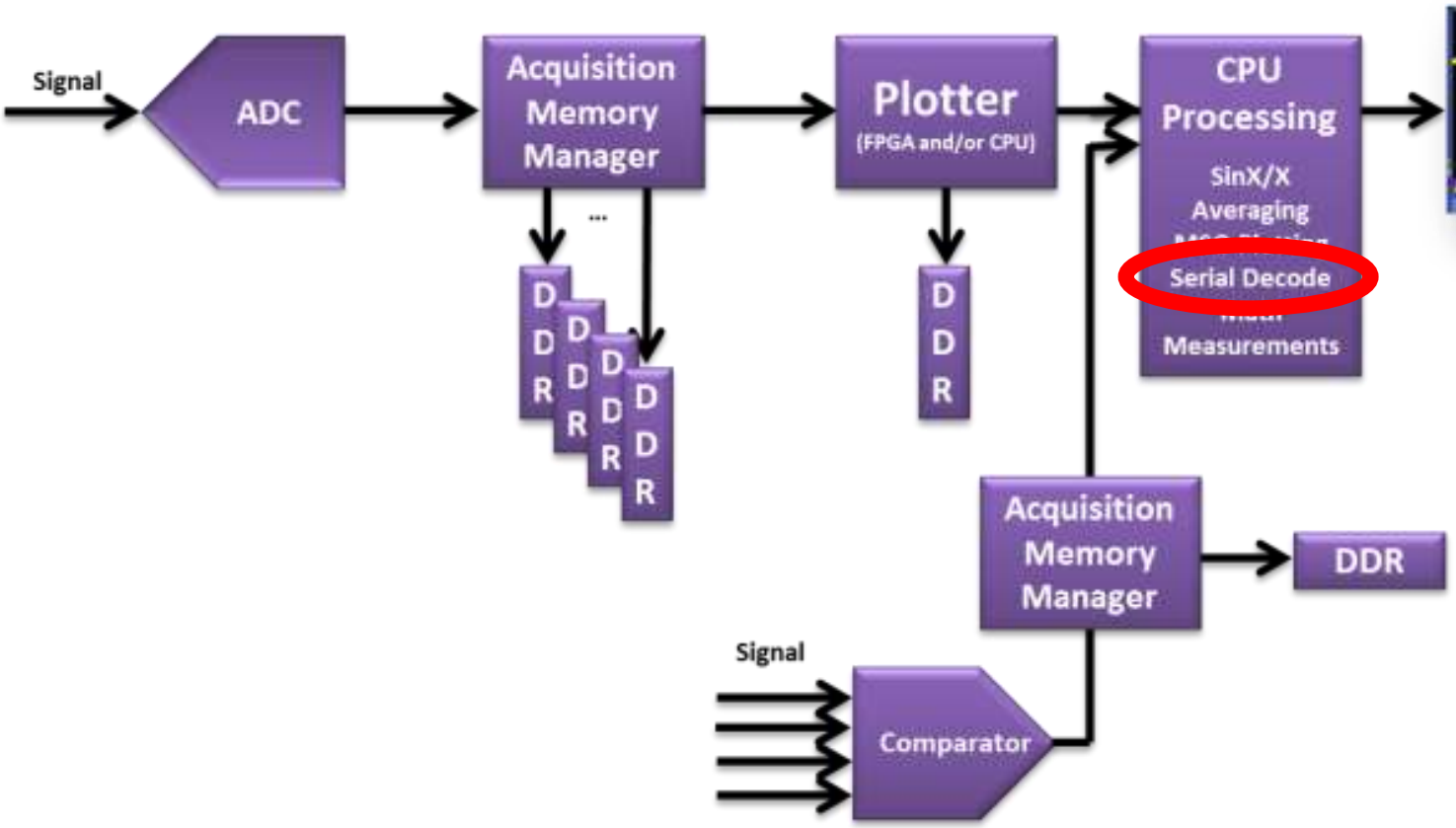

# Lab #5

Serial Trigger and Decode

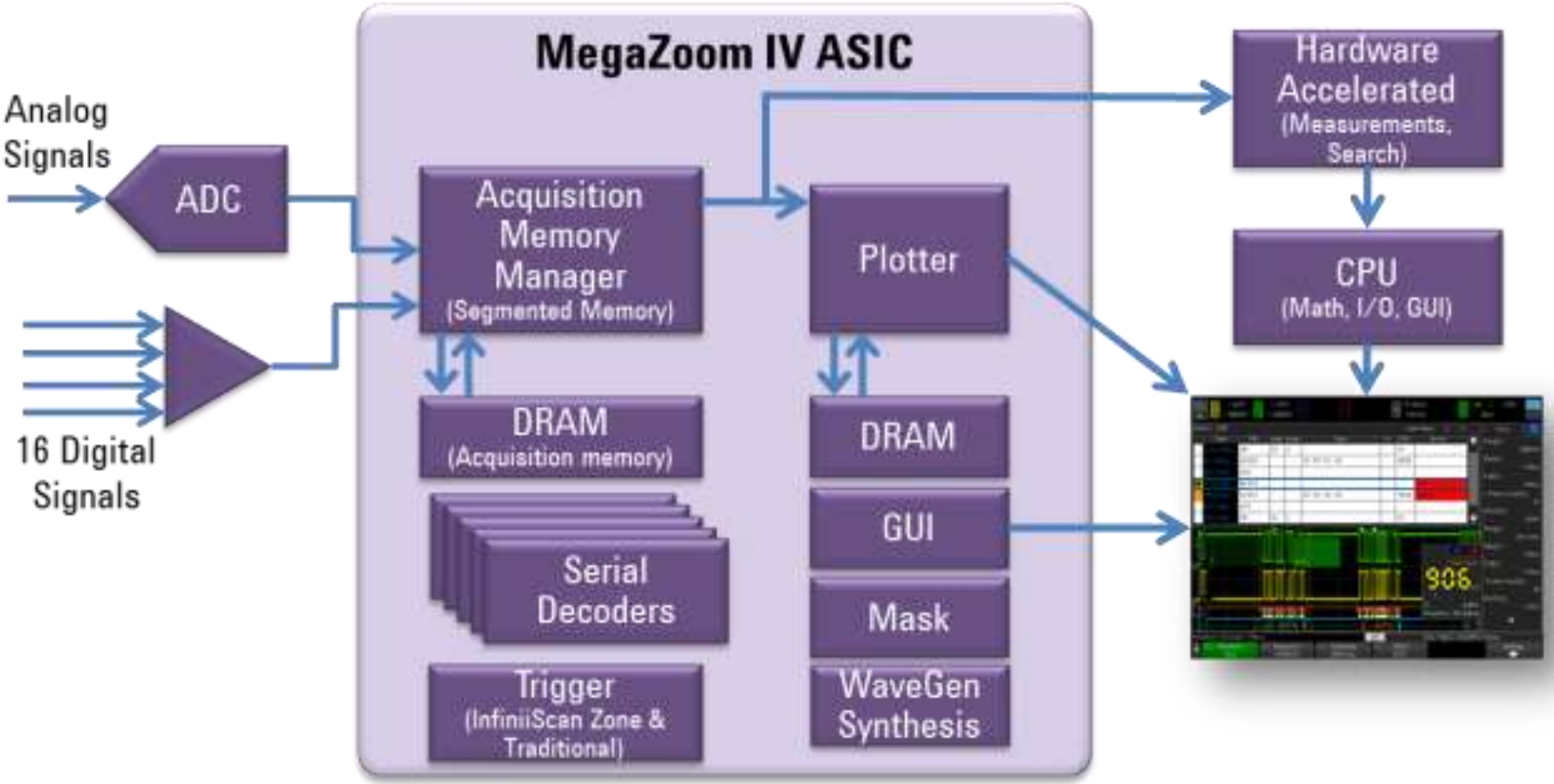
# Benefits of a Hardware Decoder

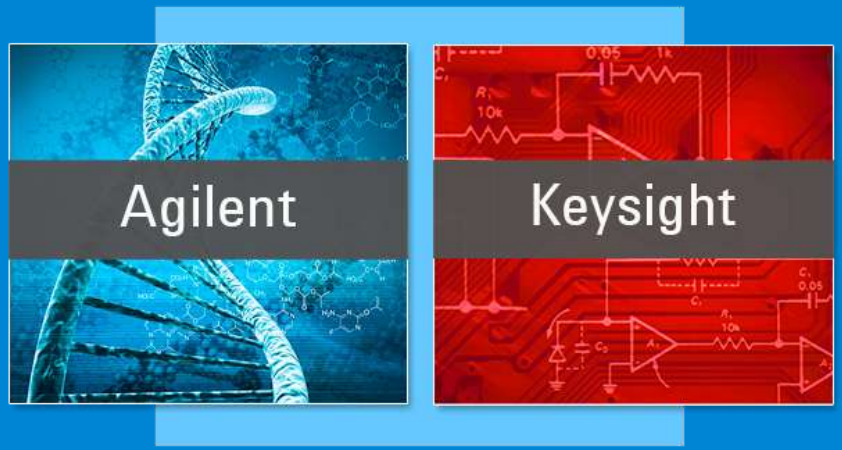
- A mixed signal design is showing some analog integrity problems.
- You wish to determine the effect of the analog signal integrity on the corresponding digital signals.
- You need a fast update rate to capture and visualize the analog problems, and also need serial decode to make sense of the digital signals.
- No problem!

# Traditional CPU Architecture



# Agilent's MegaZoom IV Architecture






# Lab #6

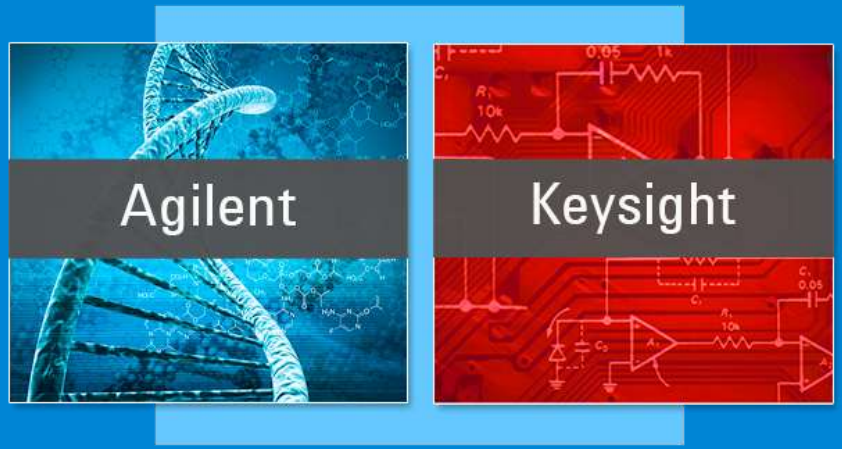
Arbitrary Waveform Generator

# Agilent X-Series Oscilloscopes are 5-in-1 tools

We offer five different tools in one footprint:

- Oscilloscope: Analog signal visualization
- Logic Analyzer: Digital signal visualization
- Protocol Analyzer: Fast protocol trigger and decode
- Function Generator: Dual function/arbitrary generators
- DVM: 3 bit digital voltmeter

# Wrap Up




What Did We Learn?

# InfiniiVision 4000 X-Series Scopes: **Experience the *Integration***

**Five in one integration –**

***Giving you tools to solve your problems, fast.***


**Fully Upgradable**

- Best in class to **1.5 GHz**
- WaveGen built-in **dual channel** 20MHz arbitrary/function generator
- **MSO** with +16 digital ch.
- Protocol analyzer with hardware-based serial decode, including **USB**
- **DVM** integrated 3-digit voltmeter

# Supercharge Your Oscilloscope Bandwidth for FREE!


## *SAME BUDGET, MORE BANDWIDTH*

Stretch your budget further by ensuring you have enough bandwidth for future projects.

This promotion discount gives customers the next higher bandwidth model at the same price–within the same series and same channel count.

**Qualifying Agilent oscilloscope families**:

- InfiniiVision 4000 X-Series
- InfiniiVision 3000 X-Series
- InfiniiVision 2000 X-Series
- 1000A Series
- 1000B Series

# Upgrade to your Ultimate Scope

**Start date: April 1, 2014**
**End date: September 30, 2014**
**No promotion number required**

## Upgrade to your Ultimate Scope with the InfiniiVision X-Series Application Bundle

This product application bundle provides full access to all licensed application software for the 2000 X, 3000 X, or 4000 X-Series upon its purchase, with the exception of the MSO upgrade option.

Program Application Bundle Product Numbers*:

- DSOX4APPBNDL for the InfiniiVision 4000 X-Series
- DSOX3APPBNDL for the InfiniiVision 3000 X-Series
- DSOX2APPBNDL for the InfiniiVision 2000 X-Series

**www.agilent.com/find/ultimateoscilloscope**

***The program application bundles only include options listed in the table. Options to be released later are not included.**

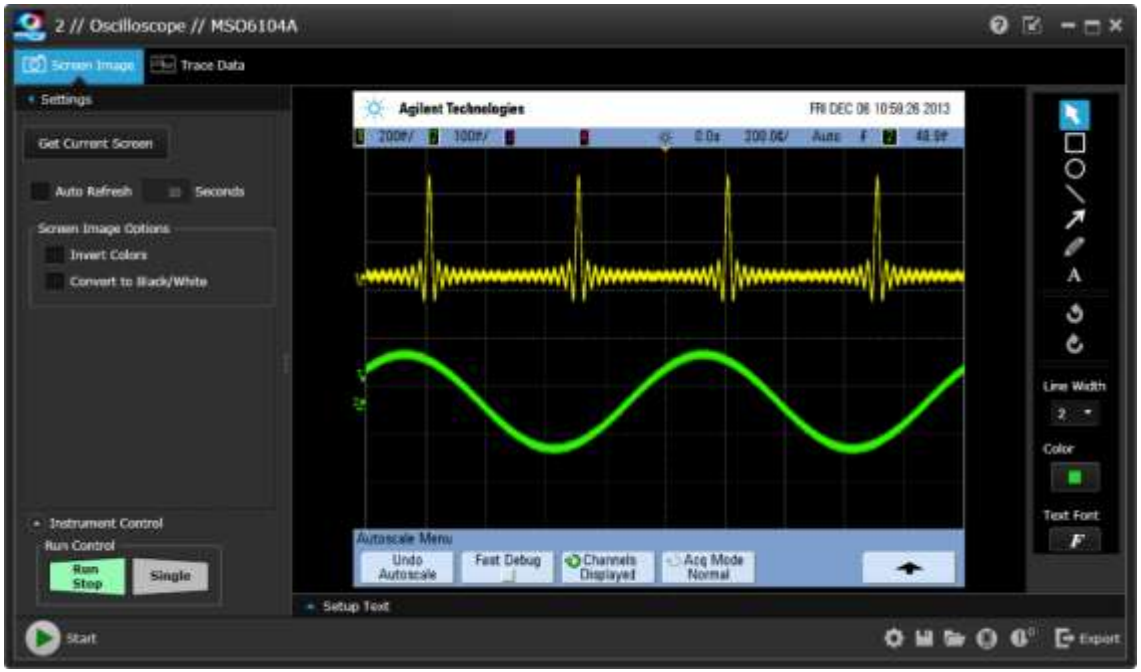
| Product # | DSOX2APPBNDL | DSOX3APPBNDL | DSOX4APPBNDL |
|---|---|---|---|
| Price | $500 | $800 | $1,500 |
| Licensed application software enabled | DSOX2AUTO | DSOX3ADVMATH | DSOX4AERO |
| | DSOX2COMP | DSOX3AERO | DSOX4AUDIO |
| | DSOX2EMBD | DSOX3AUDIO | DSOX4AUTO |
| | DSOX2MASK | DSOX3AUTO | DSOX4COMP |
| | DSOX2MEMUP | DSOX3COMP | DSOX4EMBD |
| | DSOX2SGM | DSOX3EMBD | DSOX4FLEX |
| | DSOX2WAVEGEN | DSOX3FLEX | DSOX4FPGAX |
| | DSOXDVM | DSOX3MASK | DSOX4MASK |
| | DSOXEDK | DSOX3MEMUP | DSOX4PWR |
| | | DSOX3PWR | DSOX4USBFL |
| | | DSOX3SGM | DSOX4USBH |
| | | DSOX3VID | DSOX4USBSQ |
| | | DSOX3WAVEGEN | DSOX4VID |
| | | DSOXDVM | DSOX4WAVEGEN2 |
| | | DSOXEDK | DSOXDVM |
| | | | DSOXEDK |

# InfiniiVision 4000 X-Series Oscilloscopes

*DSO and MSO Oscilloscopes*

| DSOX/MSOX | 4154A | 4104A | 4054A | 4052A | 4034A | 4032A | 4024A | 4022A |
|---|---|---|---|---|---|---|---|---|
| Bandwidth | **1.5 GHz** | **1 GHz** | **500 MHz** | | **350 MHz** | | **200 MHz** | |
| Analog channels | 4 | 4 | 4 | 2 | 4 | 2 | 4 | 2 |
| MSO channels | 16 logic timing analyzer channels | | | | | | | |
| Max Sample Rate | 5 GSa/s | | | | | | | |
| Max memory | 4 Mpts MegaZoom IV acquisition memory | | | | | | | |
| Display | 12.1-inch capacitive touchscreen | | | | | | | |
| WaveGen | Dual-channel 20 MHz Function/Arbitrary Waveform Generator | | | | | | | |
| Update Rate | 1,000,000 waveforms/sec | | | | | | | |
| Serial Protocol Analysis | USB 2.0, I2C, I2S, RS232/UART, SPI, ARIC 429, MIL-STD 1553, CAN, FlexRay | | | | | | | |
| Upgradability | Bandwidth, MSO, WaveGen and measurement applications | | | | | | | |

# BenchVue: Oscilloscopes




## Supported Functionality

- Instrument Control
- Capture and annotate screen
- Capture trace data
- Exporting
  - Screenshots
  - Data
- Save/recall instrument state
- BenchVue Mobile

## Supported Instruments:

- MSO/DSO-X 2000, 3000, and 4000 Series; MSO/DSO 6000 Series; DSO/MSO 7000 and 9000 Series

# Thank You!


Unlocking Measurement Insights for 75 Years