## Architecture for Improved Interchangeability   (IVI-MSS)

- ## Measurement and Stimulus Subsystems

- ## Resolves IVI-Driver limitations.
  - Can interchange an instrument of one class with that of another

  - Provision for custom code to assure the same behavior

  - Provision for aggregation of multiple instruments

- ## Can deliver "guranteeable" interchangeability.

- ## Benefits come at the cost of extra effort and constraints.

IVI   *IVI Overview*   Aug 24, 2000   1

IVI-MSS stands for Measurement and Stimulus Subsystems. This is one of the standing working groups of the IVI Foundation. IVI-MSS is an architectural approach that overcomes the limitations that come from using standard IVI drivers alone. By using IVI-MSS it is possible to guarantee the results that will be achieved when an interchange is done.

IVI-MSS adds two new Interfaces and Component Types
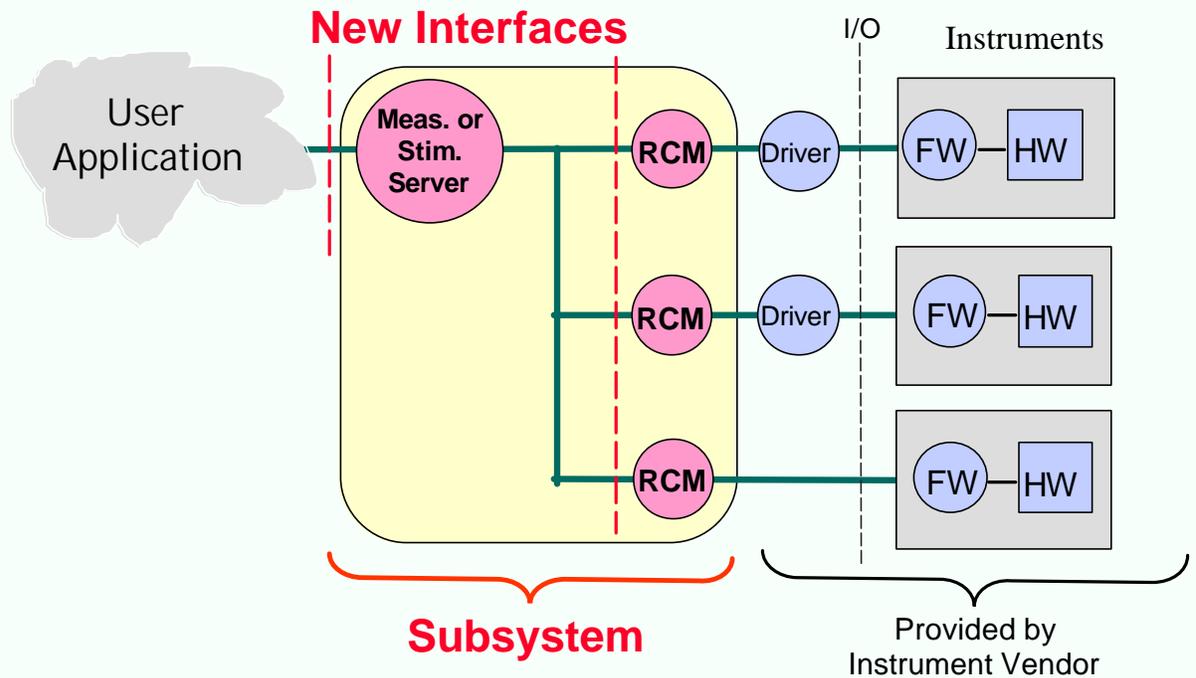
The extra effort that IVI-MSS requires is to use two additional interfaces that separate the end application program from the test instrumentation creating a new entity called a subsystem.   These interfaces are associated with two new software components which are.
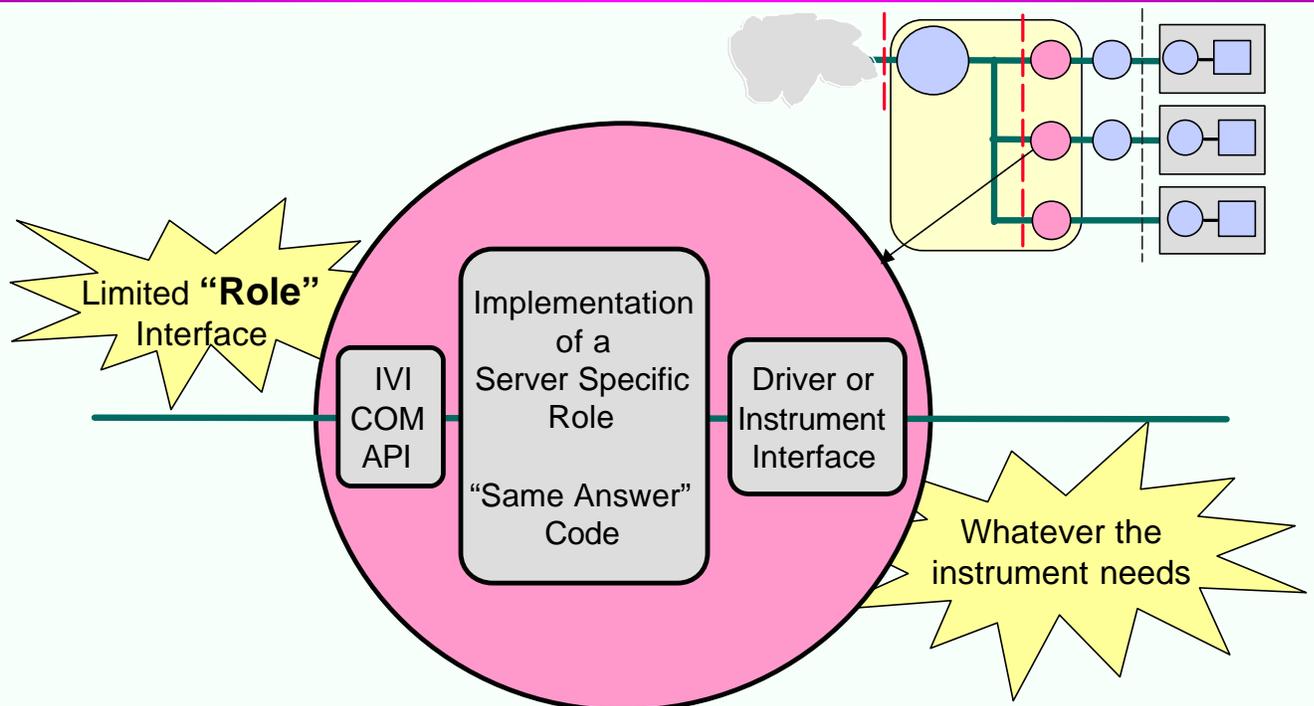
•Measurement or Stimulus Servers
These SW components encapsulate as much of the problem at hand as possible in a way that is truly test asset independent. Servers also provide for aggregating multiple instruments into a single solution.

•Role Control Modules (RCM)
At first look a Role Control Module looks like an instrument driver; however it has some very different responsibilities.

Instrument Vendor provide instruments with it's internal Firmware (FW) and Hardware (HW) along with an associated Driver. When an instrument driver does not exist, a RCM can serve the purpose.

Inside a Role Control Module (RCM)

Limited **"Role"** Interface

IVI COM API

Implementation of a Server Specific Role

"Same Answer" Code

Driver or Instrument Interface

Whatever the instrument needs

A Role Control Module (**RCM)** is required for each Asset used by a Measurement Server in a subsystem. Each RCM has an interface to a specific Measurement or Stimulus Server. This interface presents only the features and capabilities required for a single "ROLE" in a subsystem.   When necessary, an RCM contains the software that will make a less complex instrument or device to meet the requirements of the role interface. This code goes in the "Same Answer" block. Any measurement software that would have to be rewritten for a new asset must be put in the RCM and not the Measurement Server. RCMs are part of the value added for a measurement subsystem. A key point is that they are owned by the "Solution Provider" not the general purpose instrument manufacture. RCMs are the key element in providing improved asset interchangeability.

What is a ROLE: A "band pass filter" on the feature set of a physical instrument. A "role" is an interface to a Measurement Server providing just what it needs and NOTHING else. A role has a rough correspondence to various types of instrumentation. A real Measurement or Stimulus Subsystem will probably require several roles.

A Role is an interface contract between a IVI-MSS Server and a particular hardware asset.

The Driver or Instrument interface of an RCM will use an instrument's IVI Class compliant Driver when available. This is not required however. A RCM is allowed to use what ever is needed to communicate with its associated asset.

Role Control modules are IVI Configurable components and are registered inside of the IVI configuration store.
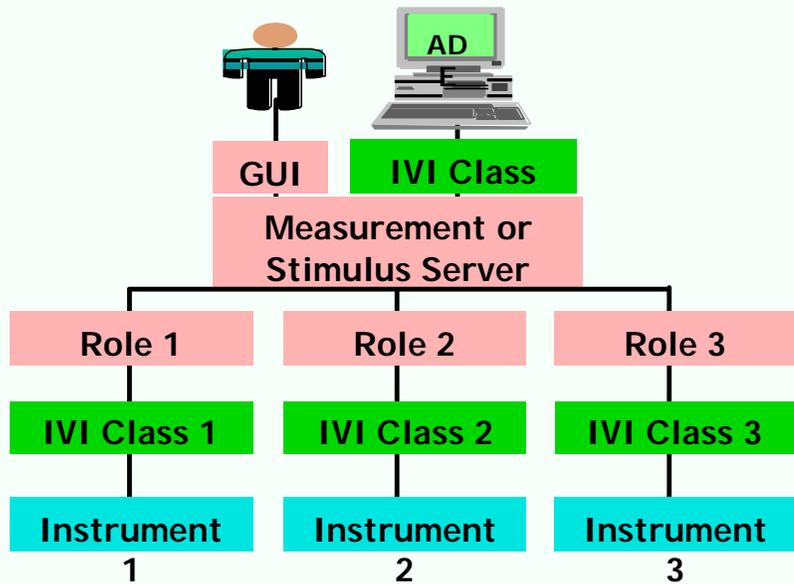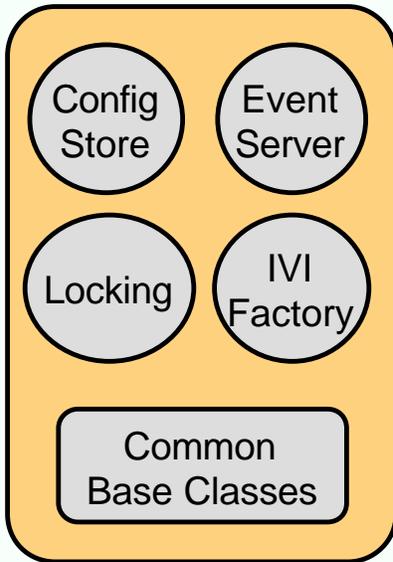
IVI Drivers vs. IVI-MSS
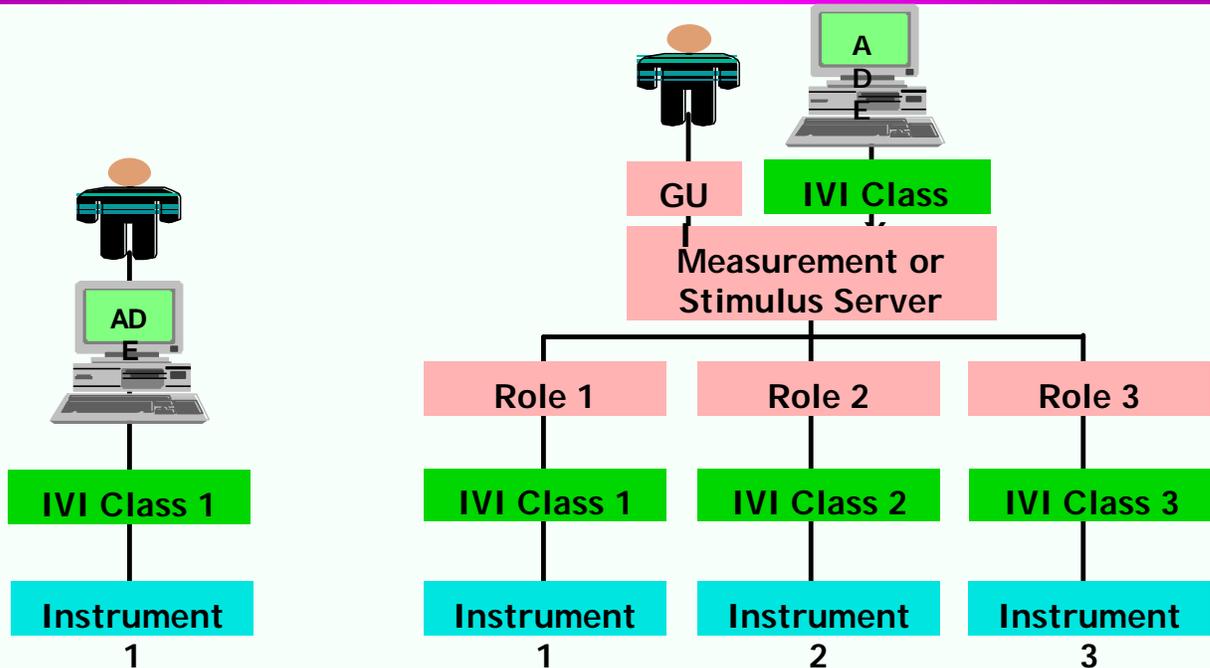
Two examples show the use of IVI Drivers with and without the added complexity of IVI-MSS.

On the left is the most common and simplest application of IVI technology. It shows a user interacting with an application that was developed using an Application Development Environment (ADE). The application uses the capabilities of a physical instrument through a IVI Class drivers. This is the base IVI approach.

On the right hand side you can see how IVI-MSS makes it possible to to create a Measurement or Stimulus Subsystem turn key solution. The key differences in are:

- The use of Role Control Modules to deliver "Guarenteeable" interchangeability
- The use of a Server to contain the reusable domain knowledge or measurements.
- The use of Aggregation to allow multiple instrument to be used together in a single solution.
- The provision of a GUI so the Solution can be used manually as well as automatically by a separate application program.

IVI Common Shared Components

There are several IVI Foundation defined software components that are useful and in some cases required, to use IVI Drivers or in building IVI-MSS based solutions. These common components are being developed in the IVI Foundation and will serve as systems glue.

Config Store
The Configuration Store is a COM Component and associated set of data the keeps track of the I/O addresses of assets in the system and also keeps track of which instruments are to be used for what purpose.

Event Server
The Event Server accepts callouts from the various components to collect asynchronous events. It time stamps and records this data and makes it available for a variety of uses.

IVI Factory
The IVI Factory is responsible for instantiating the various COM components in the system such as IVI Drivers, Role Control Modules and Measurement or Stimulus servers. It also provides handles to the clients of these components.
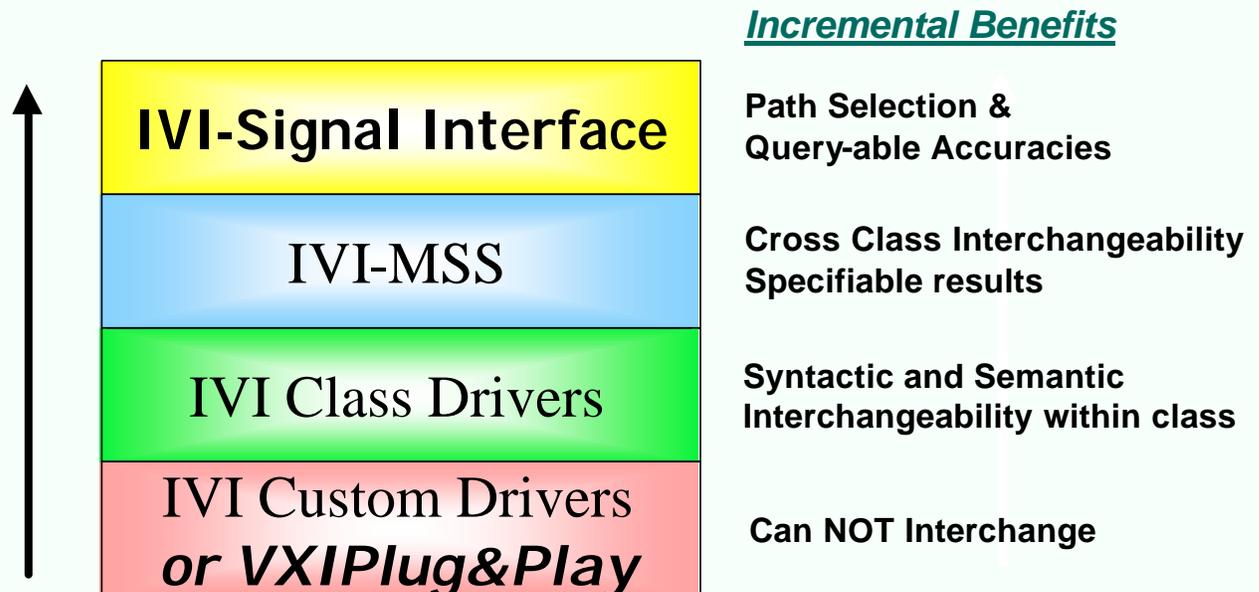
Locking
The Locking component keeps track of which instruments are being used and allows for sharing them or blocking access to them if they are busy.

Common Base Classes
Common Base classes for both Measurement Servers and Role Control Modules can make it easier to build Measurement Subsystems and will contribute to their overall quality and common "look and feel"

Degrees of Interchangeability

Incremental Benefits

IVI-Signal Interface

**Path Selection &
Query-able Accuracies**

IVI-MSS

**Cross Class Interchangeability
Specifiable results**

IVI Class Drivers

**Syntactic and Semantic
Interchangeability within class**

**IVI Custom Drivers
*or VXIPlug&Play***

Can NOT Interchange

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There are varying degrees of interchangeability.

Make the assumption that an end user's application program is written four ways. 1st it is written to directly use VXIplug&play driver or IVI Custom Driver APIs, 2nd it is written to use IVI-Class Compliant instrument Drivers making the assumption that these are "off the shelf" commercial IVI-drivers, 3rd it is written to use an IVI-MSS based solution, and 4th it is written to a IVI-Signal Interface.

The VXIplug&play or Custom IVI Driver version of the application will not provide interchangeability.   As soon as an instrument is interchanged and its associated driver is placed in the system; the application will no longer work. Function names will be different and there will be compiling and linking errors.

In the case of the IVI-Driver version of the application; the application should run and there will be no need to recompile or relink. One must make the assumption that no Instrument specific functions have been called. If there are no instrument peculiarities or "second order" effects the application should provide expected results.

In the case of the IVI-MSS version of the application; At the cost of additional complexity, a "Solution Provider" can guarantee that the "same answer" will be obtained after a "supported interchange". The interchanged asset can have instrument peculiarities or "second order" effects. The interchanged assets can even be of a different instrument type as long as it is physically capable of performing the physical stimulus or measurement that is required by the solution. IVI-MSS is not an alternative to the IVI Class Drivers which still have value within IVI-MSS based solutions. IVI-MSS involves extra work. The IVI-MSS specification that is under development specifies how and where this work is done.

Finally for those who must have the highest degree to instrument interchangeability; the Signal Interface permits an ATS to query for the actual specifications, accuracies, and capabilities of the measurement or stimulus hardware. This makes it possible to support automatic resource selection and allocation. In addition the signal interface layer, offers a way to describe the connections of signals to D.U.T test ports. The Signal Interface specification is under development and would be used in conjunction with both IVI-MSS as well as IVI Class Drivers.

It is critical to identify the owner of the various interfaces.   Having the several layers makes it possible for various participants in the ATS business to have places to express their requirements or to deliver the value of their solutions.