EMMA: A New Paradigm in Configurable Software

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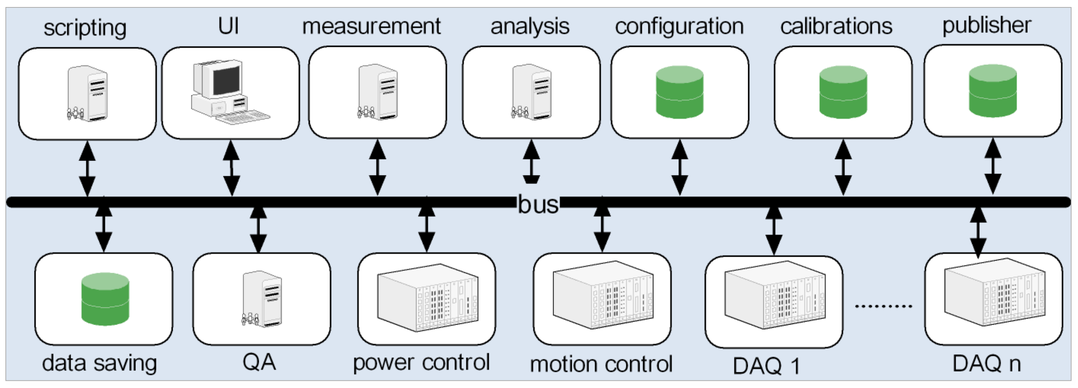
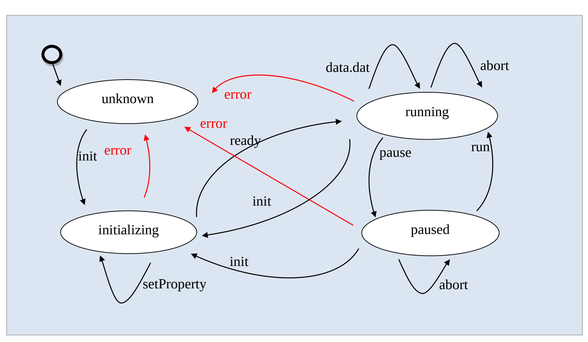
Architecture



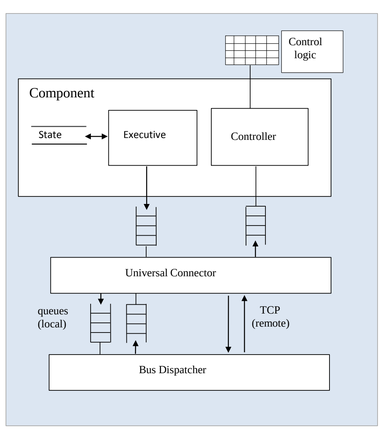
Message-based communication using a publish- subscribe bus.

- Configurable component-based framework for building measurement and test systems.
- Components communicate via a publish-subscribe bus, subscribing to topics.
- Local components communicate via queues, and remote components via TCP/IP (Internet sockets).
- Automation is provided via Python scripting.

Component



A standard dynamic model of a component.



Component internal organization.

- A state machine defines the behavior of a component.
- State machines are defined externally as matrices.
- Components have properties which alter their behavior .
- Control events direct actions performed by components.
- Components are also data driven.

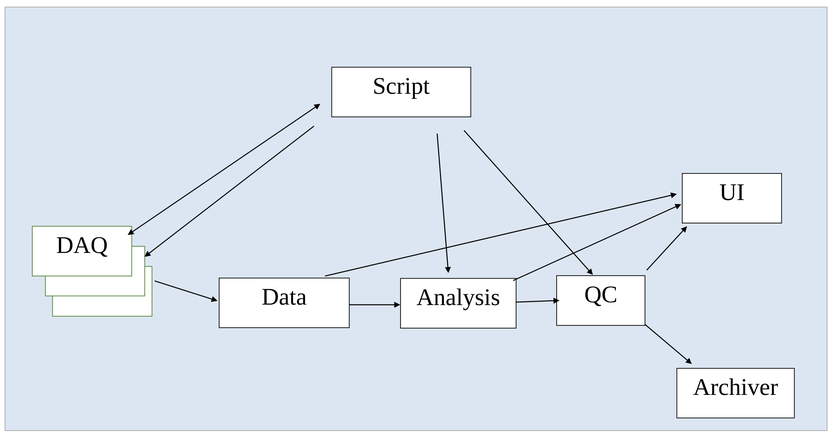
System Configuration

```
; Initial values of  system properties
[system]
systemProperty_1 = value_1
systemProperty_2 = value_2
…
; Non-standard (system- specific) components
[components]
component_1 = local:pathToVI          ; local component
component_2 = remote:pathToVI         ; remote component
…
; Automatic initialization events: topic:event = parameter
[events]
control:init.cmd = NONE
control.component_1:connect.cmd = NONE
…
; Properties of components: property = value
[component_1]
property_1.1 = value_1
property_1.2 = value_2
…
[component_n]
property_n.1 = value_1
property_n.2 = value_2
…
```

Structure of the EMMA configuration file.

- EMMA-based systems are configurable via a file
- Framework uses the configuration to start both local and remote components
- A configuration file has system, components, events, and component property sections.
- Each file section contains a set of name-value pairs that define the initial state of the system.

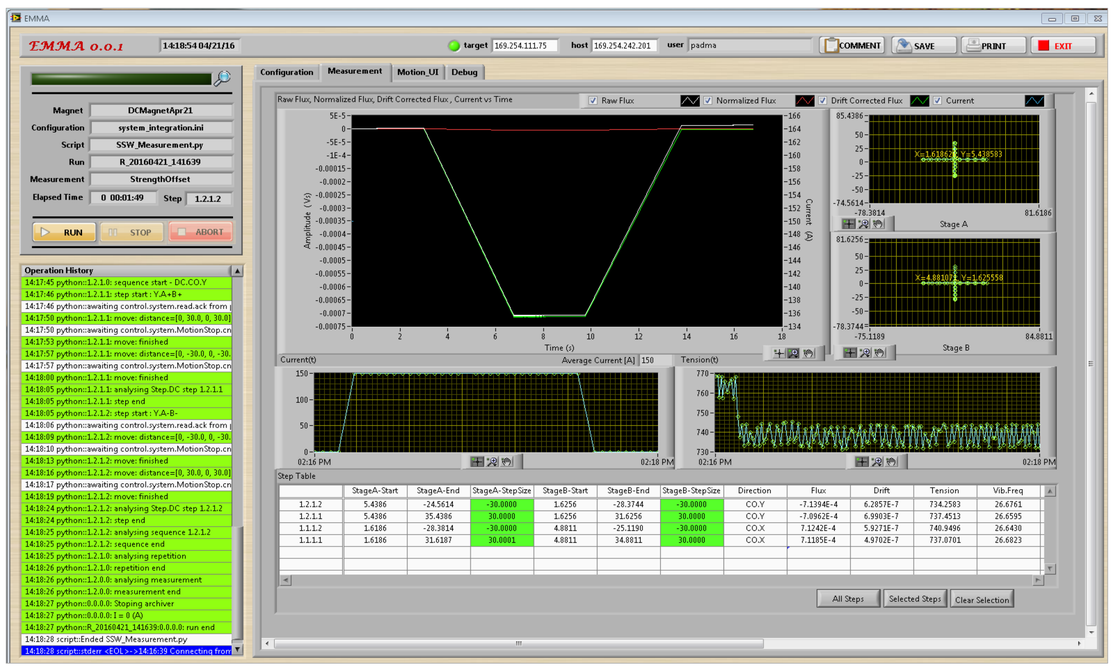
System Coordination via Scripting



Measurement collaboration diagram.

Component coordination can be implemented as orchestration via a parameterized script or data-driven component choreography. The script directs measurements through communicating with components by exchanging Control and Property messages. Choreography is accomplished via data events.

User Interfaces



EMMA Stretched-Wire Magnetic Measurement System – Measurement View.

The EMMA UI is based on a configurable shell and allows for embedding UI components into pre-allocated panels implementing viewports to component functionality and I/O. In addition, UI components can be configured to run as standalone top-level windows.

Features of EMMA Framework

- Configurable
- Extensible
- Composable
- Flexible
- Loosely coupled components
- Reusable components
- Instrumentation interface-agnostic (e.g., PXI, cRIO, GPIB, LXI)