



ICALEPCS
CAPE TOWN
SOUTH AFRICA **2023**

ACCELERATING CONTROL SYSTEMS
FOR GROUNDBREAKING SCIENCE



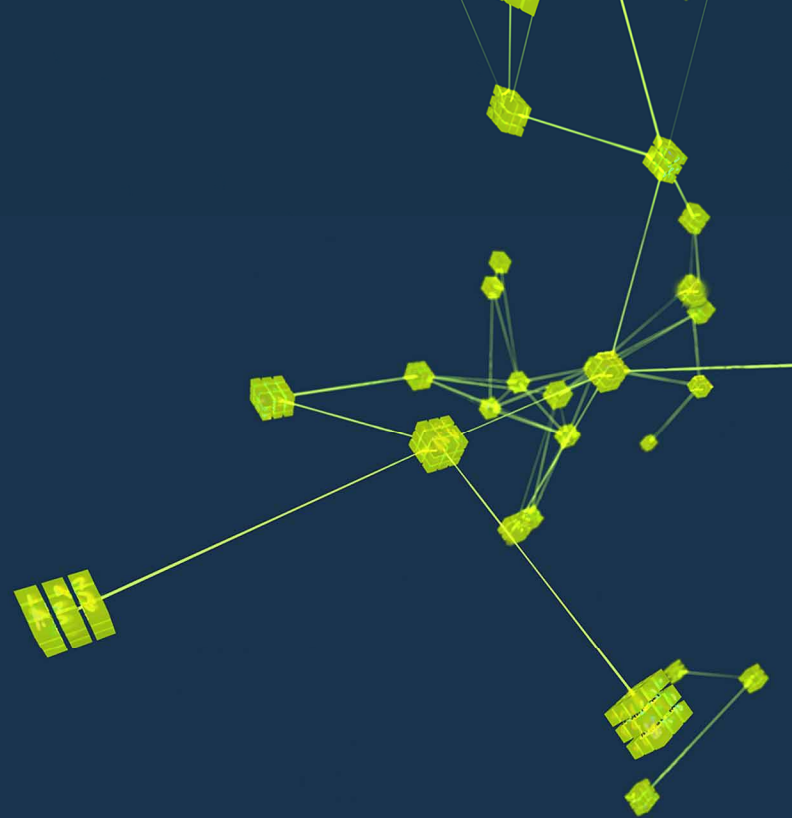
EPICS
ITU



Five Years of EPICS 7
Ralph Lange for the EPICS Developers

Outline

- Creation
 - Initial goals of the EPICS 7 project
 - The pvAccess protocol
- Evolution
 - Normative Types
 - Integration in the EPICS context
 - Use cases for the new protocol
 - Increased adoption in the community
- Plans
 - IPv6 support
 - TLS security on the network



CREATION

EPCS 7 AND ITS INITIAL GOALS

Initial Goals

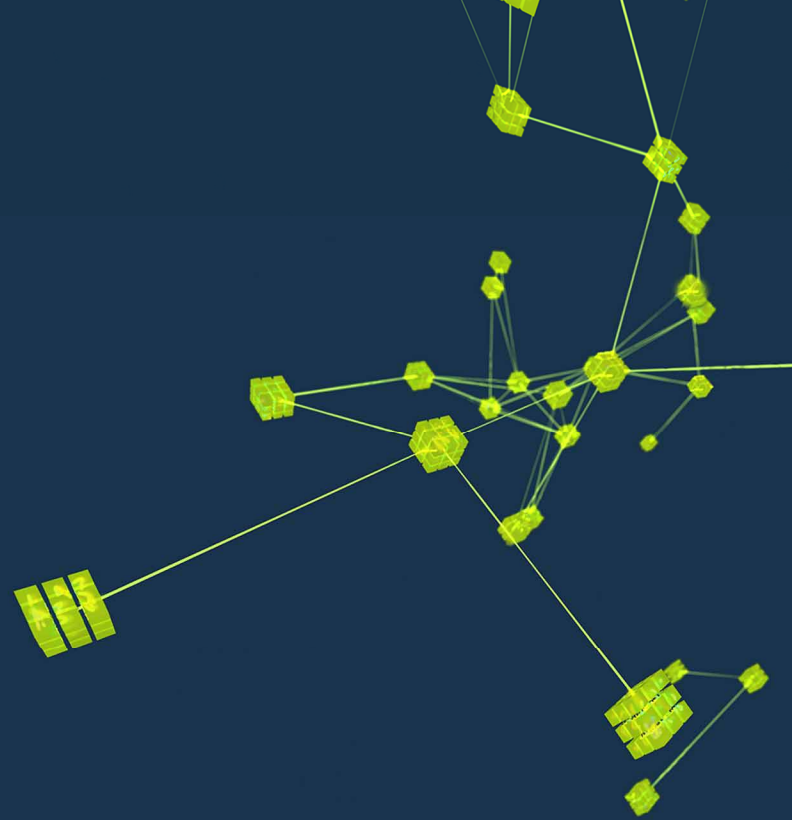
Leave no lab behind

- Don't break the IOC (Input/Output Controller) software
- Extend the scope, allowing migration for existing installations
- Provide a migration path with minimal configuration
- Include user-level libraries for Java, C++, Python

pvAccess

Transporting arbitrary structures efficiently

- Based on a reasonable set of standard types and arrays, plus structures of those, plus variants
- Similar to Channel Access in many aspects
 - Client needs to know the name, not the server
- Subscriptions are very efficient
 - On opening a subscription, the client gets a full structure copy
 - Any further updates only contain the elements that have changed
 - The client has a consistent full copy at any time



EVOLUTION

THE LAST FIVE YEARS

Normative Types

Arbitrary structures can be a bad idea

- Normative Types define standard structures for standard use cases
 - All fixed structure types of Channel Access are covered
 - Plus: 2D array, table, image (+ metadata), time series, channel collection, ...
- Generic clients (e.g., GUI, Archivers) understand Normative Types

Integration

Fitting in with the others

In the IOC:

- PVA server allows access to all records.fields using Normative Types
- Multiple record.fields can be configured into an arbitrary structure

In clients, like GUI frameworks and archivers:

- In Phoebus, channel names are prefixed with “ca://” or “pva://” with a configurable default
- The Archiver Appliance always searches on both protocols to provide consistent archive data across migration

Use Cases

Things that were not possible before

- Images:
An image Normative Type contains image and metadata in a single structure; clients always have a consistent set
- Middle-layer services:
The RPC-type method (request/response with changing payload) allows wrapping database, model or directory service calls
- Transactional configuration:
Using the RPC type method, a client can write configuration for a complete subsystem in a single structure

Adoption

Important new and upgrade projects have selected EPICS 7

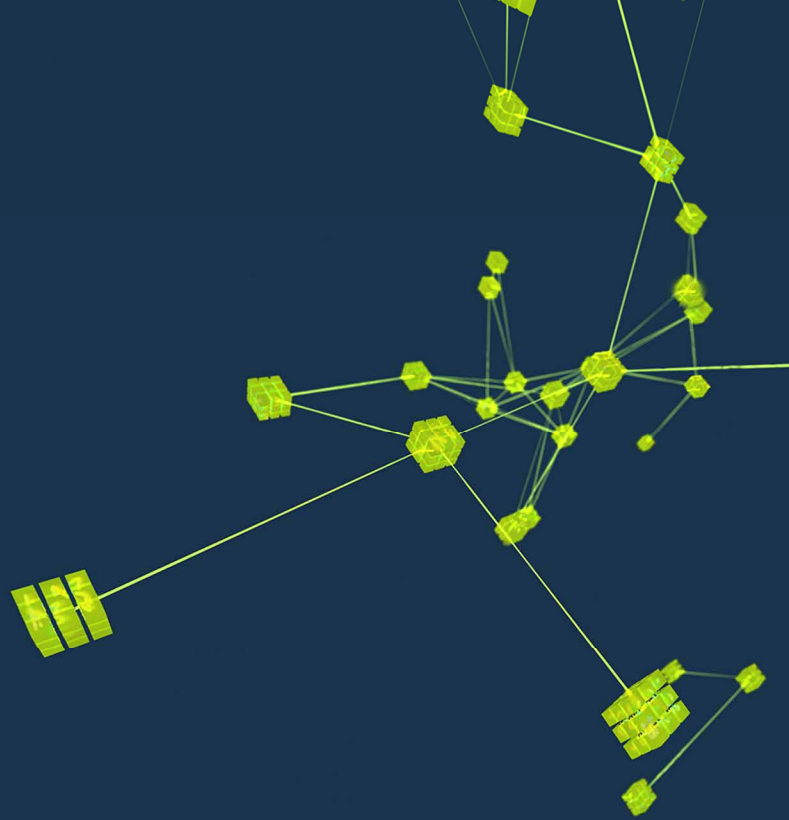
- New installations can start using pvAccess
- There's a smooth migration path for existing installations

User-level libraries:

- Second generation libraries make better use of language specifics

Real-time for legacy VME:

- RTEMS is well supported in EPICS 7



PLANS

CURRENT PROJECTS

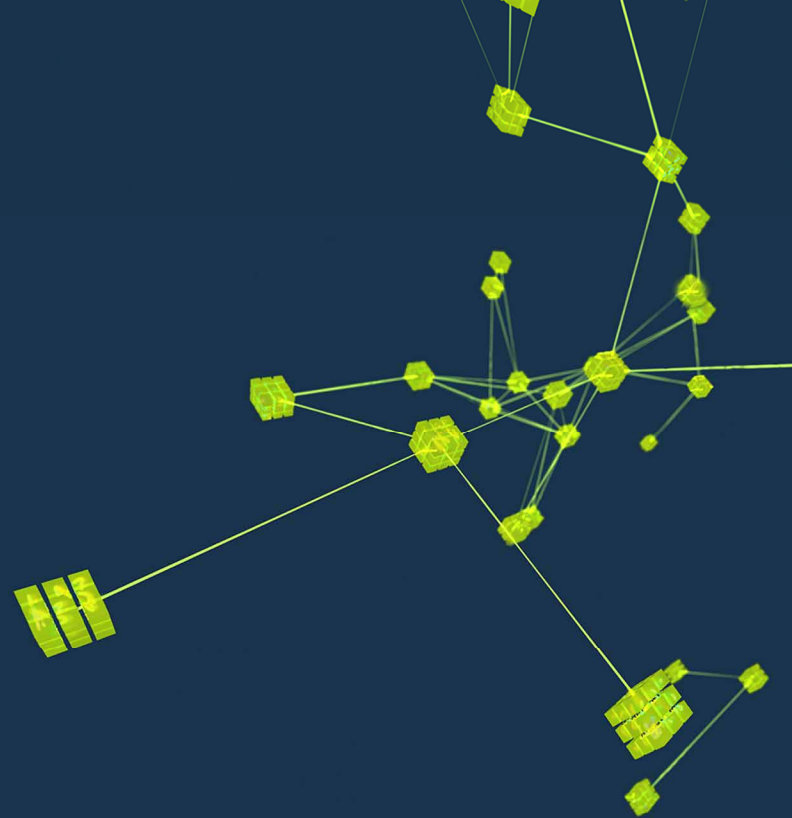
IPv6

- The second generation libraries support IPv6

Security

- At SLAC, a multi-year project has started that will add industrial-level security TLS-style security to the pvAccess protocol
- The hard part, i.e. key management, is still in early design phase

CONCLUSIONS



Conclusions

- All initial goals of the development have been met
- The migration path works: we see increasing adoption and use
- Users are beginning to explore the new possibilities
- Future challenges are being addressed
- Of course, there is still room for improvement

After 30 years, the EPICS network protocol was successfully modernized.

Thank You for Your Attention!

