GENICAM 2.0

New Major Release of the Generic Interface for Cameras

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Chair of the GenICam Standard Group

Version 1.0

BASLER VISION TECHNOLOGIES

Overview

- GenICam for the Industry
- GenICam Modules
  - GenApi
  - SFNC
  - GenTL
  - CLProtocol
- New in Version 2.0
- How to Participate

What is GenICam?

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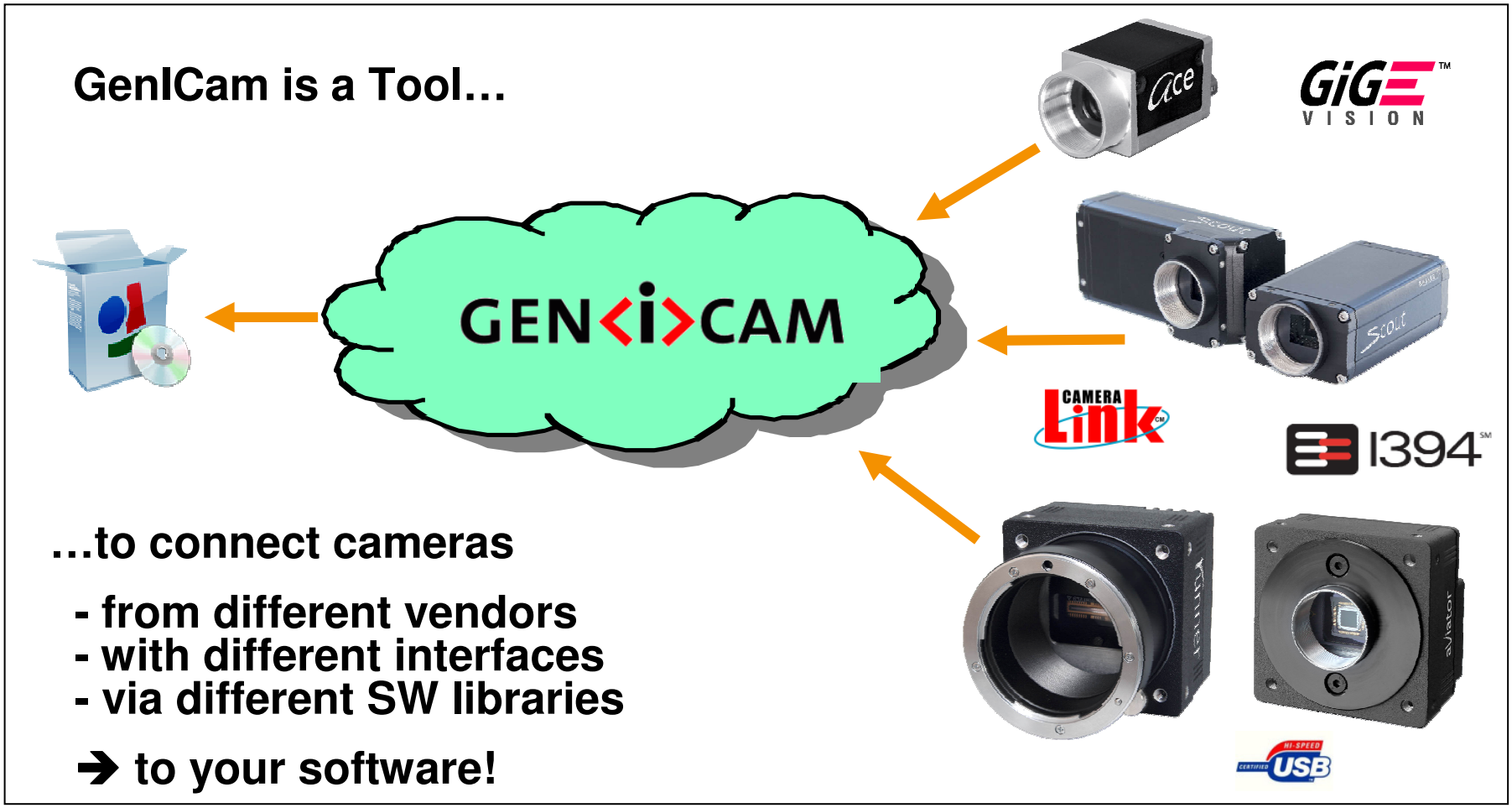

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Who is GenICam Member? ➔ 72 Companies in Total

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Who is Driving GenICam Actively?

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History

- 7 years of intense work
- 19 international meetings
- 10..14 out of 72 members form the core team
- Common code base maintained by the group
- Homework between meetings
- Voting rights are tied to contribution (=homework) yielding in very fast progress

		June 2003	October 2003	May 2004	June 2004	September 2004	December 2004	April 2005	July 2005	October 2005	November 2005	December 2005	February 2006	June 2006	May 2007	September 2007	April 2008	October 2008	April 2009	September 2009	April 2010
Basler	18	x	x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
Stemmer	17		x	x		x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	
DALSA/Coreco	17	x	x	x		x	x	x	x	x		x	x	x	x	x	x	x	x	x	
JAI/Pulnix	16	x	x	x		x	x		x	x		x	x	x	x	x	x	x	x	x	
Leturon	14					x	x	x	x	x	x	x	x	x	x	x	x	x	x		
e2v (ex ATMEL)	13	x				x	x	x	x	x			x	x	x	x	x	x	x		
MvTec	13							x	x	x	x	x	x	x	x	x	x	x	x	x	
Pleora	13	x	x	x				x	x				x	x	x	x	x	x	x	x	
Matrox	10		x	x								x	x	x	x	x	x		x	x	
NI	9			x								x	x	x	x	x	x	x		x	
Euresys	7											x	x		x	x	x	x	x		
Toshiba/Teli	4													x		x	x	x			
IDS	4														x	x	x	x			
AVT	4														x	x	x	x			
PhotonFocus	4	x	x	x		x															
SVS-Vistec	3											x	x						x		
Matrix Vision	3														x	x			x		
Sick	2											x	x								
Kappa	2																		x	x	
Cognex	1																	x			
Mikrotron	1														x						
PointGrey	1																			x	
Micro Encoder	1																			x	
Lumenera	1																	x			
Impuls Imaging	1																		x		
Sensor To Image	1																		x		
VRMagic	1																		x		

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Where is GenICam Used Today?

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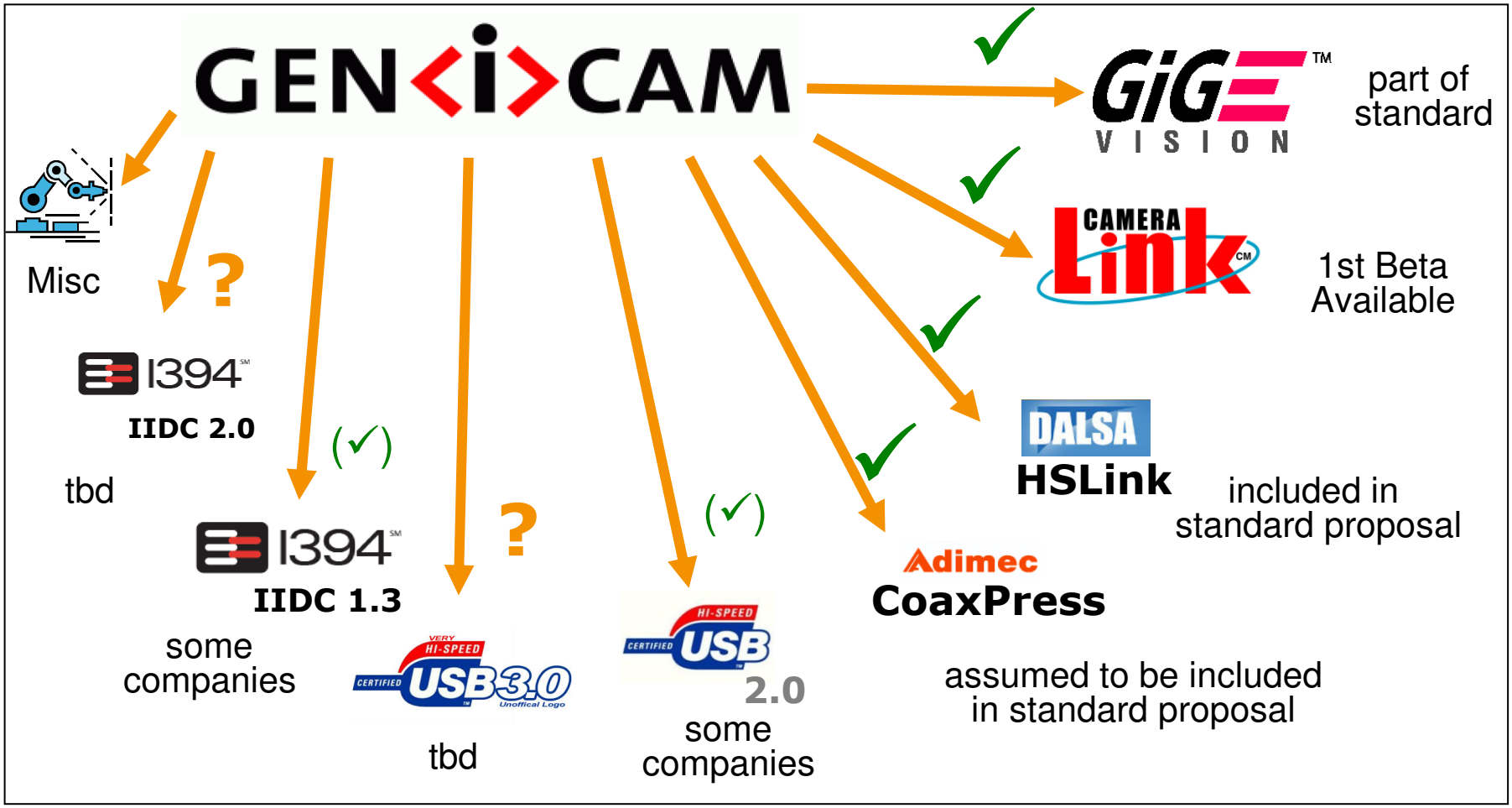

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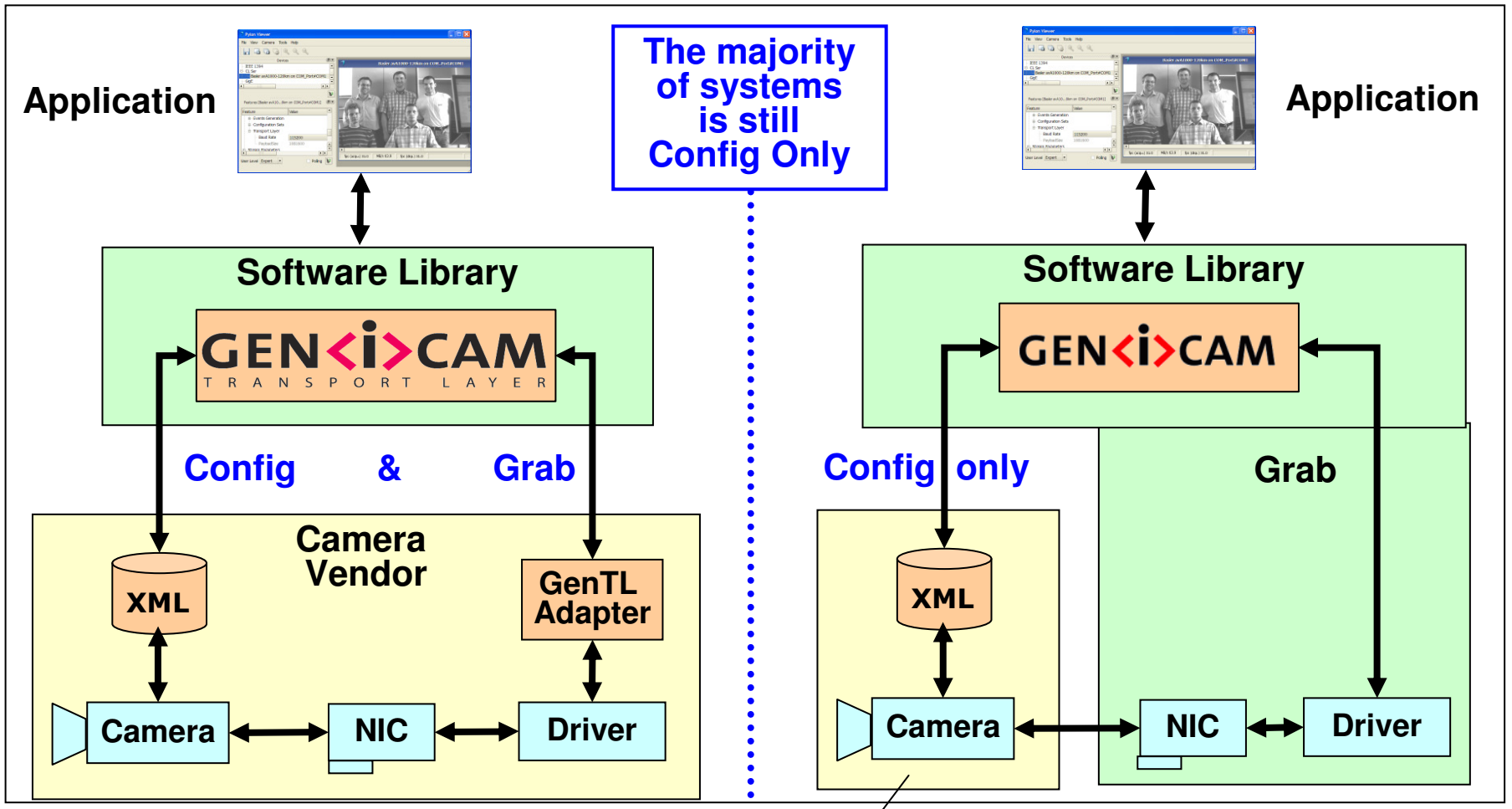
GenICam Configurations



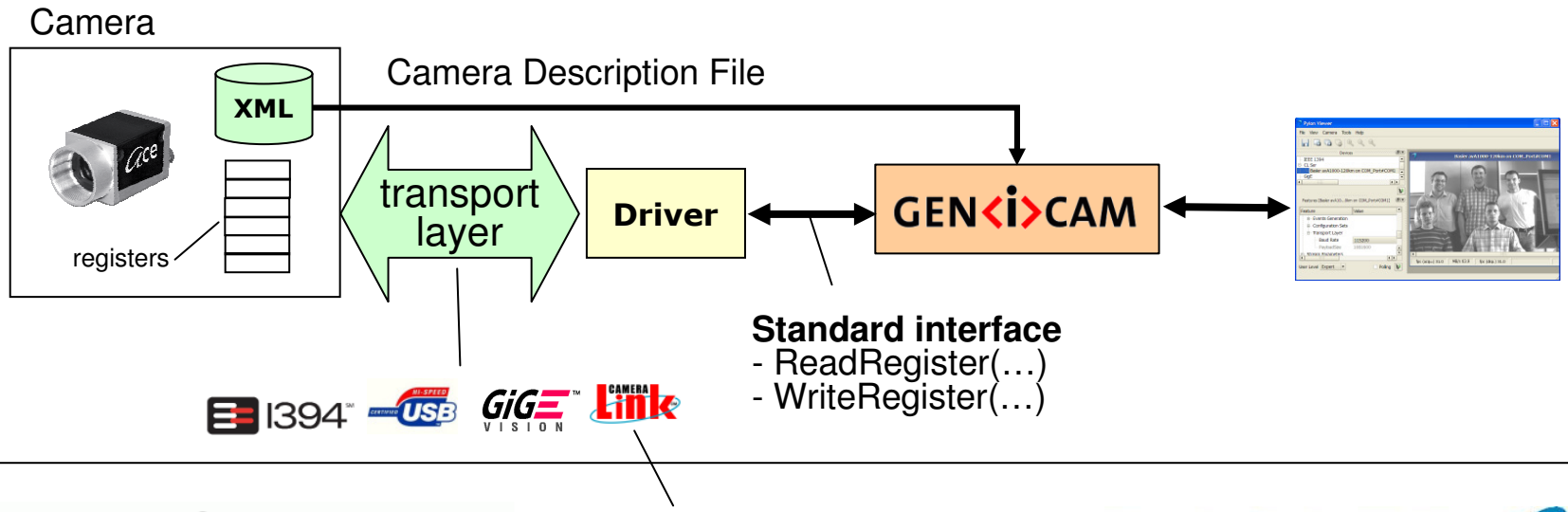
GigE Vision History

First attempt: fixed register layout

- Kick-off meeting June 2003
- Every company tried to get their proprietary register layout standardized
- After one year no conclusion was reached ➔ committee was stuck ☹

Escape Route

- Let every camera have their own register layout
- Define standard features abstractly
- Have a camera description file in XML format with describes how to map the abstract features to the registers



GenICam Modules GenApi and SFNC

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GenApi Module

- Defines the XML language of the camera description file
- Ideas
  - Supported types: Integer, Float, Enumeration, Bool, String, Command
  - Each type corresponds to an interface with methods like GetValue, SetValue, GetMin, GetMax, GetAccessMode etc.
  - Camera possesses a set of features
  - Each feature has a name, a type and a meaning ➔ abstract
- Example : IInteger::Gain // amplification

SFNC*) Module

- Defines a set of abstract features forming the ideal camera
- No details, just the name, type and meaning ➔ committee was un-stuck ☺
- List has grow to 220 features in 14 categories like ImageFormatControl, AcquisitionCotrol, AnalogControl, DigitalIO etc.

Example

- SFNC_Camera.chm
  - all standard interfaces
  - all standard features (“ideal camera”)

*) SFNC = Standard Feature Naming Convention

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History Again & Business Dynamics

GigE Vision ➔ GenICam

- GenICam can be used not only for GigE Vision but also for all register based transport layer like, e.g. 1394 IIDC, USB
- GenICam was made a separate standard
- GigE Vision refers to GenICam

What makes a Good Standard?

- Balance between interoperability and room for competition
- Custom Features in GenICam
  - XML language describes custom and standard features alike
  - Only if vendors use SFNC plug&play is achieved
- Business Dynamics
  - Camera vendors like XML language
  - Software vendors insist on SFNC usage

CameraLink ➔ not enough interoperability

- No plug&play due to extremely poor definition of configuration interface (“serial port”)
- Result
  - Every camera comes with a stand-alone configuration tool
  - Rare and restricted API only

1394 IIDC ➔ not enough room for competition

- Fixed Register Layout yields plug&play
- Problems
  - No competition for standard features.
  - It’s quite impossible to overcome restrictions of standard features, e.g. 12 bit for exposure time only
  - Extension possible but no standard way to access custom features (void* only)

GenICam Module GenTL

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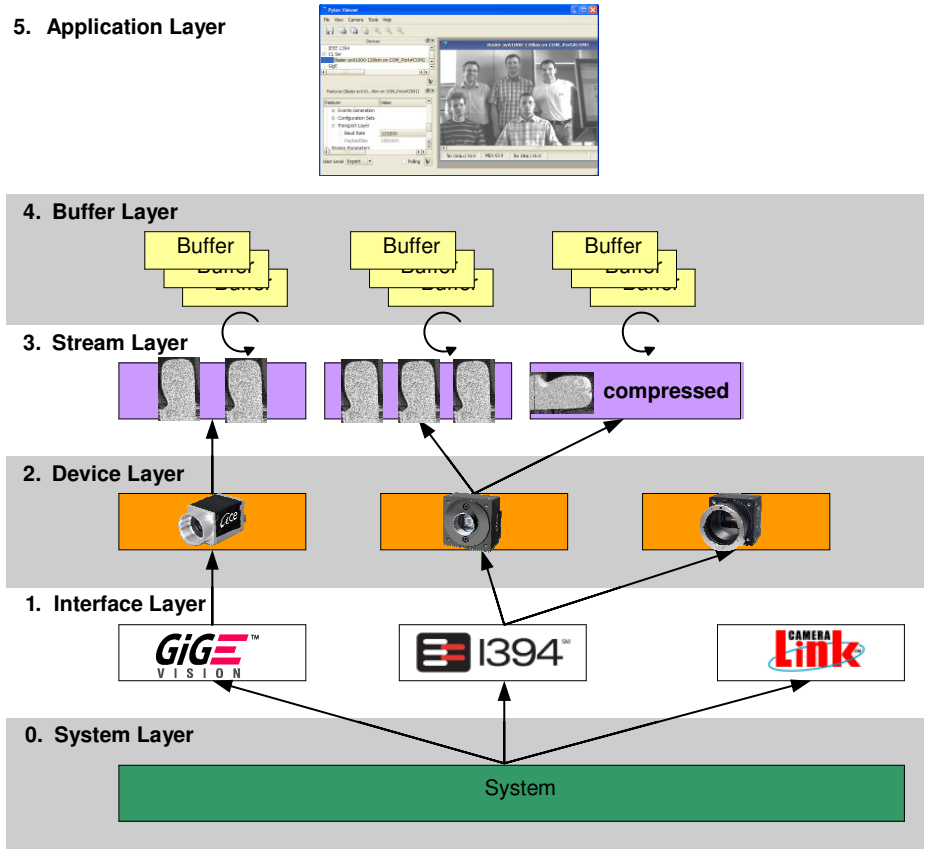
GenTL Module

- Defines an object model and abstract C++ interfaces for grabbing images
- Use Cases covered
  - Enumerating transport layers (GEV, 1394, CL, USB, …)
  - Enumerating Devices
  - Configuring Devices using GenApi
  - Opening one or more video streams
  - Buffer handling
- GenTL can handle any number of devices, drivers, and interface technologies with one common API
- It just came a little late for GigE Vision…



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Supporting CameraLink

v2.1

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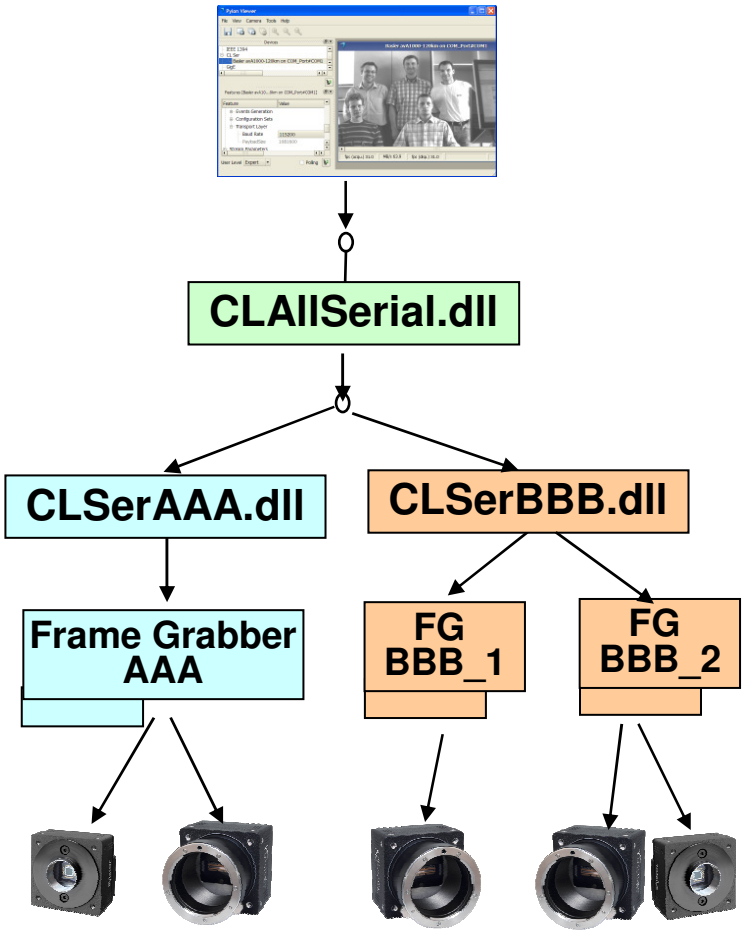
CameraLink Configuration Interface

- CameraLink provides a standard mechanism to access a serial port on the camera
- Every frame grabber comes with a port driver DLL named CLSerXXX.dll whose C interface is standardized
- The CL standard committee provides a freeware CLAllSarial.dll which covers the following use cases
  - Enumerates all CLSerXXX DLLs
  - Enumerates all frame grabber boards per DLL
  - Enumerates all camera port per frame grabber board
  - Allows to send and receive packages per camera
- Problem: No registers…



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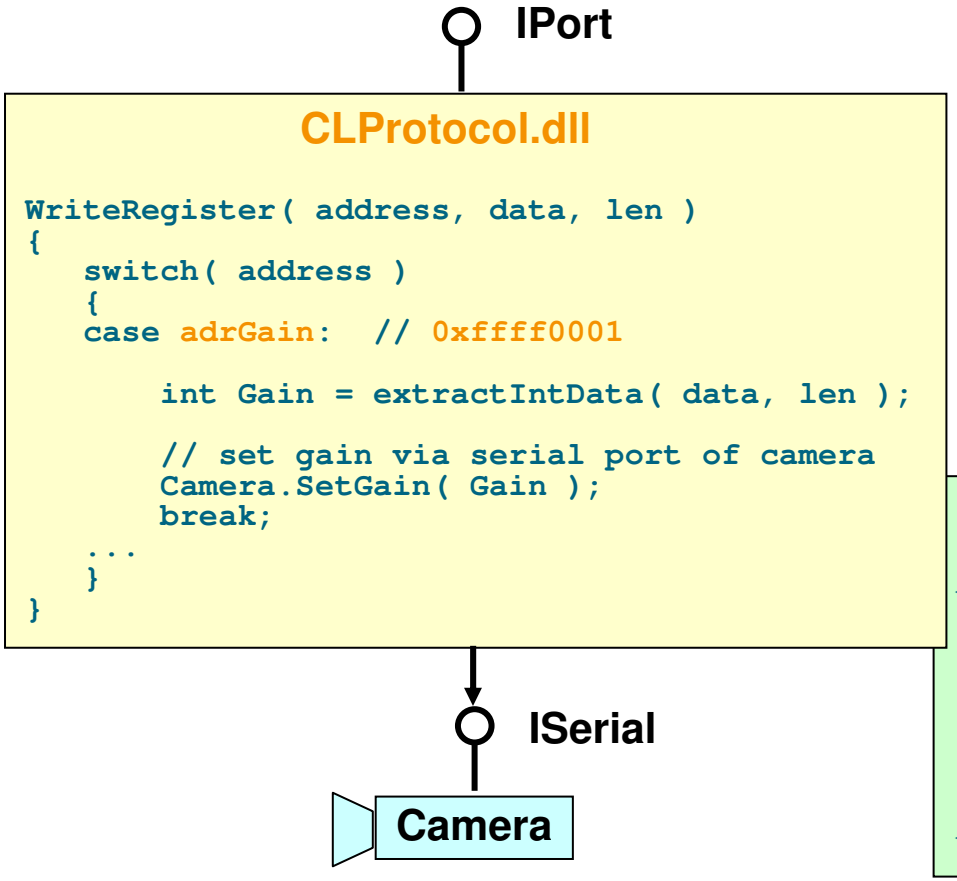
GenICam Module CLProtocol (1/2)

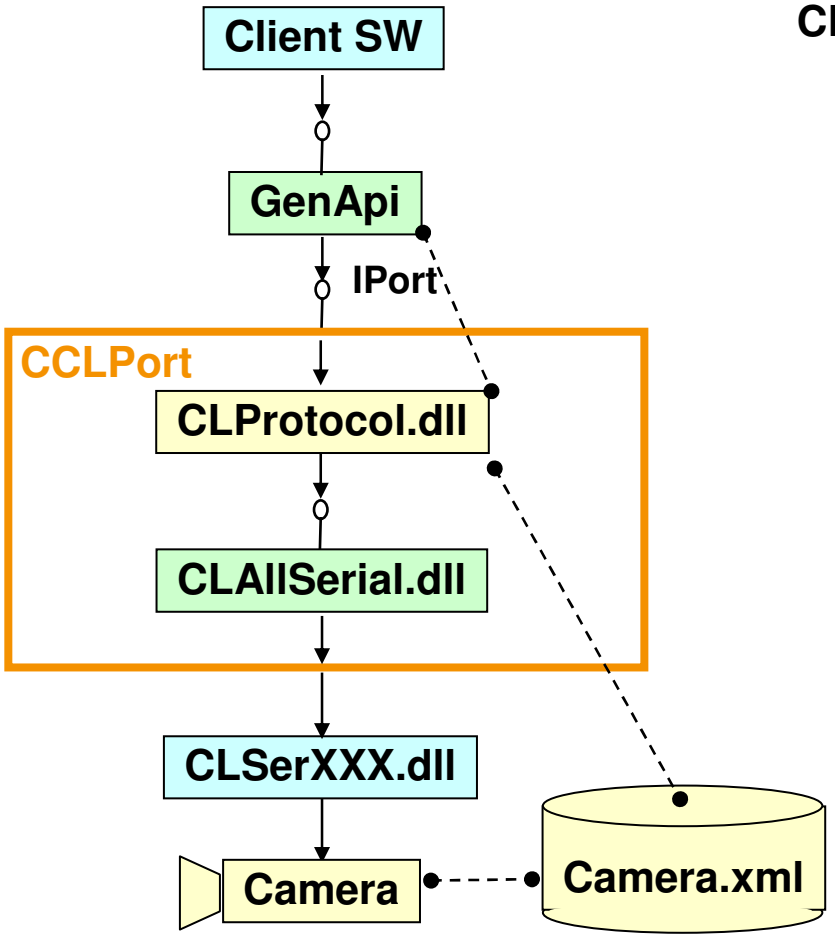


- If the camera is **register based** the CLProtocol.dll is just running a frame protocol.
- If the camera is **command based** the CLProtocol.dll needs to emulate a pseudo register space.

Camera.xml

```
<IntReg Name="Gain">
    <Address>0xffff0001</Address>
    <Length>4</Length>
    <AccessMode>RW</AccessMode>
    <pPort>Port</pPort>
    <Cachable>NoCache</Cachable>
    <Sign>Signed</Sign>
    <Endianess>LittleEndian</Endianess>
</IntReg>
```

GenICam Module CLProtocol (2/2)



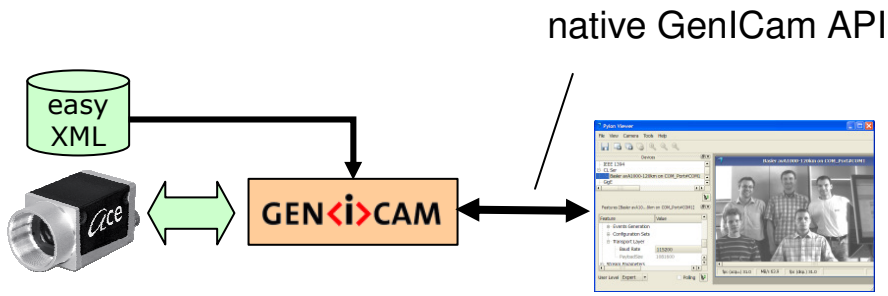
CLProtocol Module

- Defines a camera driver CLProtocol.DLL which implements a (virtual) register interface for a camera
- Camera manufacturer provides setup to install the driver besides the frame grabber software
- Use Cases covered by CCLPort wrapper class:
  - Enumerating serial ports
  - Enumerating possible driver DLL bindings
  - Dynamically loads CLProtocol.dll
  - Retrieves XML description from camera of file
  - Provides IPort interface required by GenApi

How Things Worked Out

Original Assumption

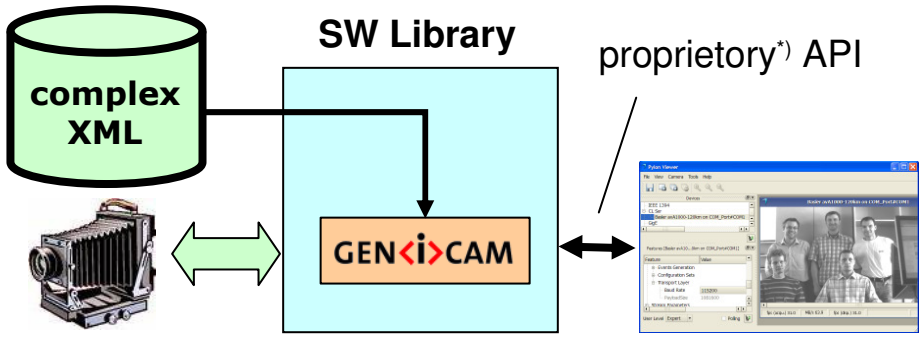
- Customers use the native GenICam API
- XML file contains a ~1:1 mapping of registers to features



What happened in Reality

- Library vendors used GenICam as engine under the hood
- Customers got the functionality of GenICam but through the libraries' native API
- XML file is used to map legacy registers to SFNC features

➔ XML language v1.0 not powerful enough for all use cases



*) some use GenICam natively; many have a back-door

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GenICam Reference Implementation

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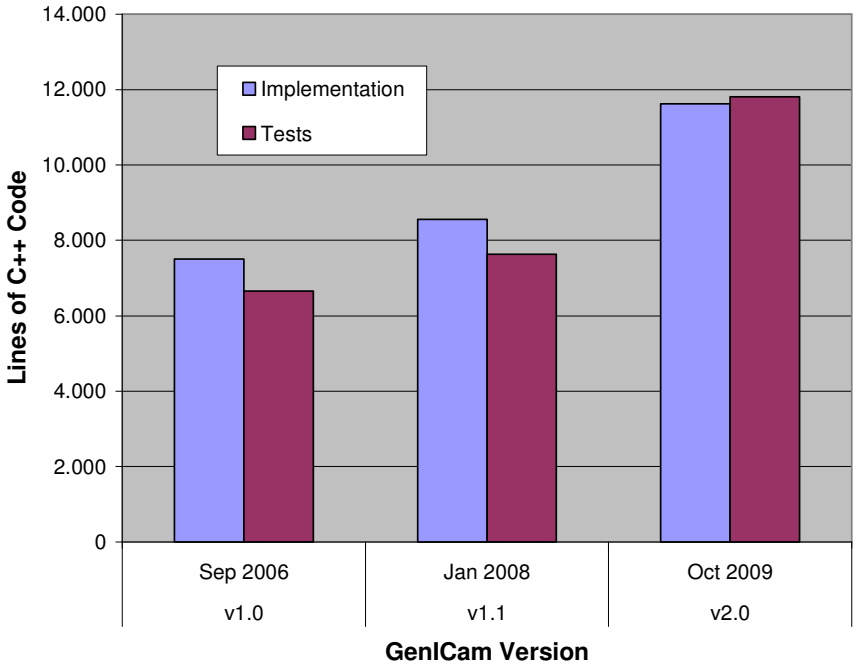
GenICam Standard v2.0

- Text of the standard modules
- XML schema file (GenApi)
- C++ Header (GenTL)

GenICam Reference Implementation v2.0

- Maintained by standard committee
- Can be used free of charge
- Not part of the standard
- Technical data
  - Written in C++
  - Supports Win32 / Win64 with VisualStudio 7.1 / 8.0 / 9.9
  - Supports Linux32 / Linux64 with Suse 10.0 (gcc>=4.0, glibc>=2.3.5)
  - Strict focus on quality

➔ **IMPORTANT** : Just the engine, no driver!



➔ v2.0 adds 50% more code

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New Features in v2.0

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General Changes

- Code refactoring (CMake)
- Speed improvement (pre-processing)
- Parallel handling of old and new schema version

Hidden Features

- Empowered XML Language
- New use cases (Replicator)
- Better maintainability (Multiplexer)
- Reduced complexity (PolyPointers)
- Better Debugging Tools (logging)
- XML Injection

Customer Features

- Supports self-clearing values
- Better formatting (float, IP, …)
- Supports error flags in the camera
- DocuURL
- Float now has an increment
- Float Aliases
  - v1.0 had multiple feature names were the committee could not agree on one type, e.g. GainRaw (Int) and GainAbs (Float)
  - v2.0 every feature is converted to Float but there are means to access the native implementation (Gain->GetIntAlias)

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Status and Roadmap

GenICam v2.0

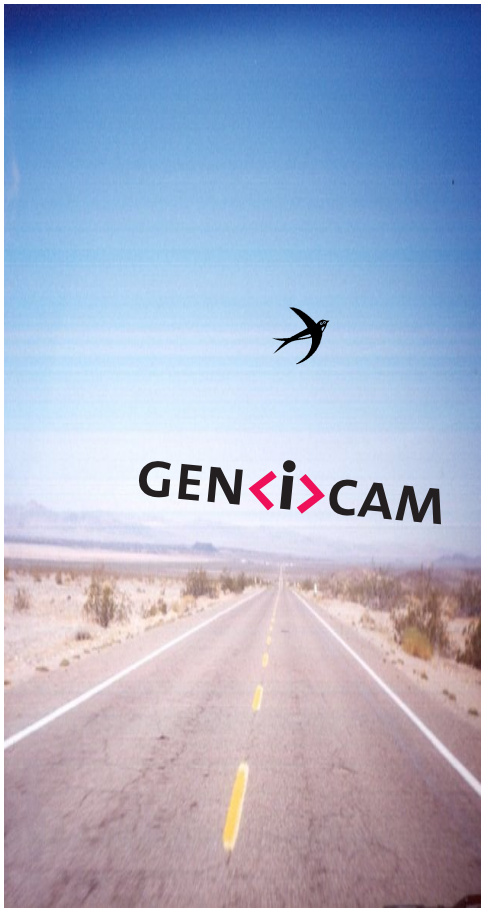
- Released
- Fully backward compatible to v1.0 cameras
- Easy migration from v1.0 to v2.0
- Rollout of products expected H1 / 2010

GenICam v2.1

- Adds Camera Link support
  - New CLProtocol module
  - CL specific features in SFNC
- Beta available
- Release expected e/o 2009

What comes next?

- Improving documentation & adding tutorials
- Supporting more compilers / platforms



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For Customers

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Sorry, but…

- GenICam is not intended to be directly used by end customers
- The reference implementation does not(!) contain a free GigE Vision driver
- The code downloadable from www.GenICam.org installs the GenICam engine only and is intended for vendors who do not want to become GenICam member

Instead, please…

- Buy GenICam aware cameras and software only
- Make sure Cameras follow the SNFC
- Make sure software libraries hand out the full functionality of GenICam
- Look out for the logos GEN<i>CAM and GEN<i>CAM TRANSPORT LAYER

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For Camera and Software Vendors

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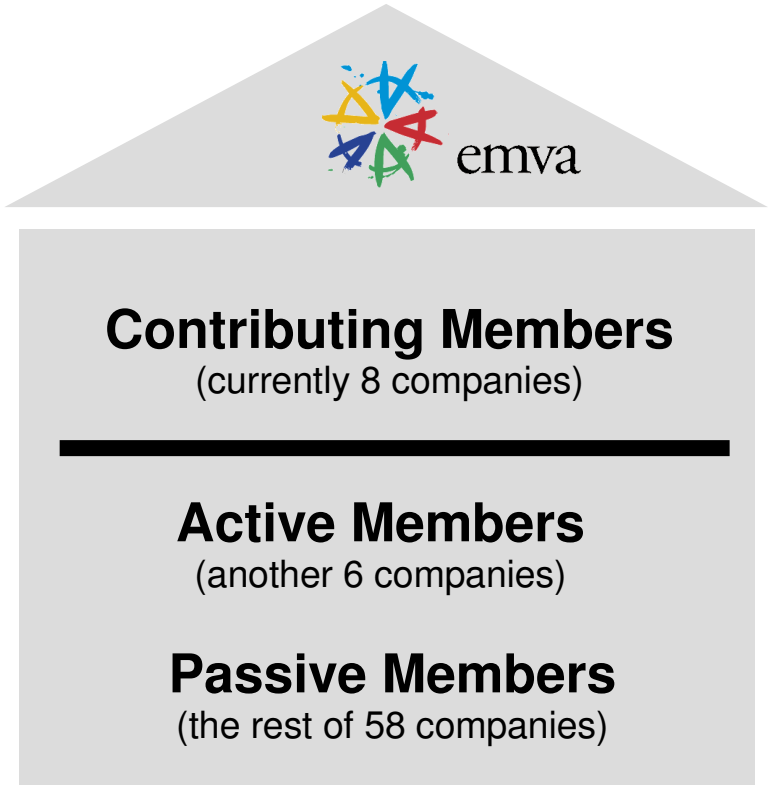
- GenICam is hosted by the European Machine Vision Association (**EMVA**)
- You can become member
  - ➔ free of charge
  - ➔ without being EMVA member

no fees!

- Membership grants you
  - ➔ access to the source code
  - ➔ access to the mailing list
  - ➔ access to the wiki and the archive
- Membership allows you to contribute
  - ➔ contribution means homework
  - ➔ only contributing members can vote
- **Register Today** at www.genicam.org



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Thank you for your attention!

Contact me ➔ friedrich.dierks@baslerweb.com

Get information ➔ www.genicam.org

Visit the International Machine Vision Standards booth for a

CLProtocol Live Demo

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