TINE + Windows CE = ??

Andres Pazos[1], Philip Duval[2]
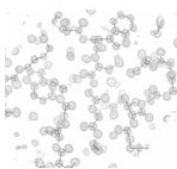[1]Petra III Instrumentation EMBL-Hamburg
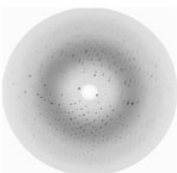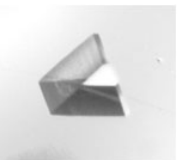[2] MST Group – DESY
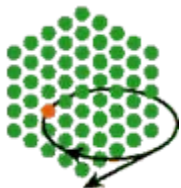
TINE Workshop September 2007
DESY - HAMBURG

Outlook

- **Windows CE**
- **Real Time OS??**
- **TINE**
- **TINE + WinCE**
- **Application System**
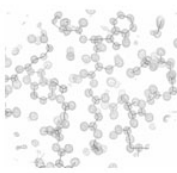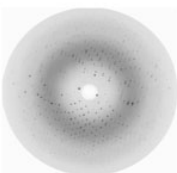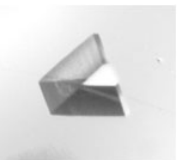- **Conclusions**

Windows CE

Windows CE

- Windows CE (Embedded OS)
  - 32-bit new architecture
  - Multitasking, multithread, scalable
  - Possible to recompile the kernel
  - Minimum kernel size: 300 Kb
  - Open Source code (special license)
- With release 6.0
  - From 32 to 32000 processes
  - From 32MB to 2 GB Virtual Memory

Release 6.0!!!

Windows CE Versions

| Product Name	Code Name	Windows CE Operating System	Applications and Shell	Desktop Synchronization Software
Handheld PC 1.0 (Released Fall, 1996)	Pegasus	1.0 Build 126-457 to 737-737	1.0	H/PC Explorer 1.0, 1.1
Embedded Toolkit 1.0 (Developers Only)	Alder	1.0	n/a	n/a
Embedded Toolkit (Developers Only) Released Fall, 1997	Birch	2.0	n/a	n/a
Handheld PC 2.0 (Released Fall, 1997)	Mercury	2.0 Build 7258-7260	2.0	Windows CE Services 2.0, 2.1
Palm-size PC 2.0 (Released Spring, 1998)	Gryphon	2.01 Build 8037-8040	1.0	Windows CE Services 2.1
Embedded Toolkit (Developers Only) Released Fall, 1998	Birch SP1	2.1	n/a	n/a
Palm-size PC 2.11 Chinese Version (Released Fall, 1998)	Orion	2.11	1.1	Windows CE Services 2.2
Handheld PC, Professional Edition (Released Fall, 1998)	Jupiter	2.11 Build 8262	3.0	Windows CE Services 2.2
Palm-size PC 2.11 US, Japanese Version (Released Winter 1999)	Wyvern	2.11 Build 9015	1.2	Windows CE Services 2.2
Video-Internet-Computers (VIC) TV_Settop Box - China (Previewed Spring 1999)	Venus		n/a	n/a
Web-Enabled Telephone (Previewed CeBIT 1999)	Hermes	2.11	n/a	n/a

| Product Name	Code Name	Windows CE Operating System	Applications and Shell	Desktop Synchronization Software
Handheld PC 2000, (Announced 9/6/2000)				
Embedded Toolkit - (Announced 2/6/2001) Windows CE.NET (10/24/01)	Talisker	4.0	skinnable UI	n/a
Pocket PC 2002 (Announced 9/6/2001, Shipped 10/4/01)	Merlin	3.0.11171 Build 11178	3.0	ActiveSync 3.5
Pocket PC 2002 Phone Edition, (Announced 2/19/02, Shipped 3/13/02)	n/a	3.0	3.0	ActiveSync 3.5
Windows CE .NET 4.1 (Announced 8/8/02)	Jameson	4.1	4.1	n/a
Smartphone 2002 (Announced 10/22/02)	Stinger	3.0	3.0	ActiveSync 3.6
Windows CE.NET 4.2 (RTM 4/23/03)	McKendric	4.2	4.2	n/a
Windows Mobile 2003 (Announced 6/23/03)	Ozone	4.20.1081 Build 13100	4.2	ActiveSync 3.7
Smartphone 2003 (Announced 10/21/03)	Ozone	4.20.1088 Build 13099, 14053	4.2	ActiveSync 3.7
Windows Mobile 2003 Second Edition (Announced 3/24/04)	Ozone Update	4.21.1088 Build 14049	4.2.1	ActiveSync 3.7.1
Windows CE 5.0 (Preview 3/29/04)	Macallan	5.0	5.0	n/a
Windows Mobile 5.0 Announced 5/10/05	Magneto	5.1.1700, Build 14334 to 14397	5.0	ActiveSync 4.0
Windows Mobile 5.0 AKU2		5.1.1700, Build 14334.2 (per Emulator) The .2 indicates AKU2	5.0	ActiveSync 4.1
Windows Mobile 6	Crossbow	5.2.318 Build 15341.0.0.0	6	ActiveSync 4.5

Windows CE – Real TIME OS?

- Real Time: specific timings requests
  - Hard real time: system fails if timings not met
  - Soft real time: system tolerates large latencies
- Windows CE
  - Priority based preemptive thread scheduler
  - Virtual memory system
  - Round-robin at a priority level
  - 256 levels of priority (0 to 96 real-time above drivers)
  - Synchronization Objects (semaphore, mutex, critical section…)
  - Interrupt Model
    - Interrupt Service Routine (ISR)
    - Interrupt Service Thread (ITR)
- Real RealTime programming
  - You have to deal with the OS
  - Some helpful tools:
    - IL Timing for ISR and ITR latency
    - OSBench for scheduler performance and kernel performance
    - Kernel Tracker shows interrupt, threads and processes interactions
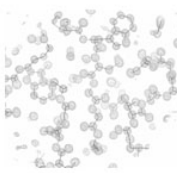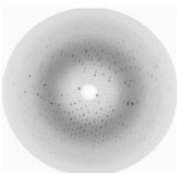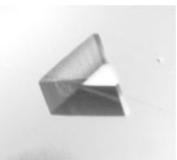
Windows CE – Real Time
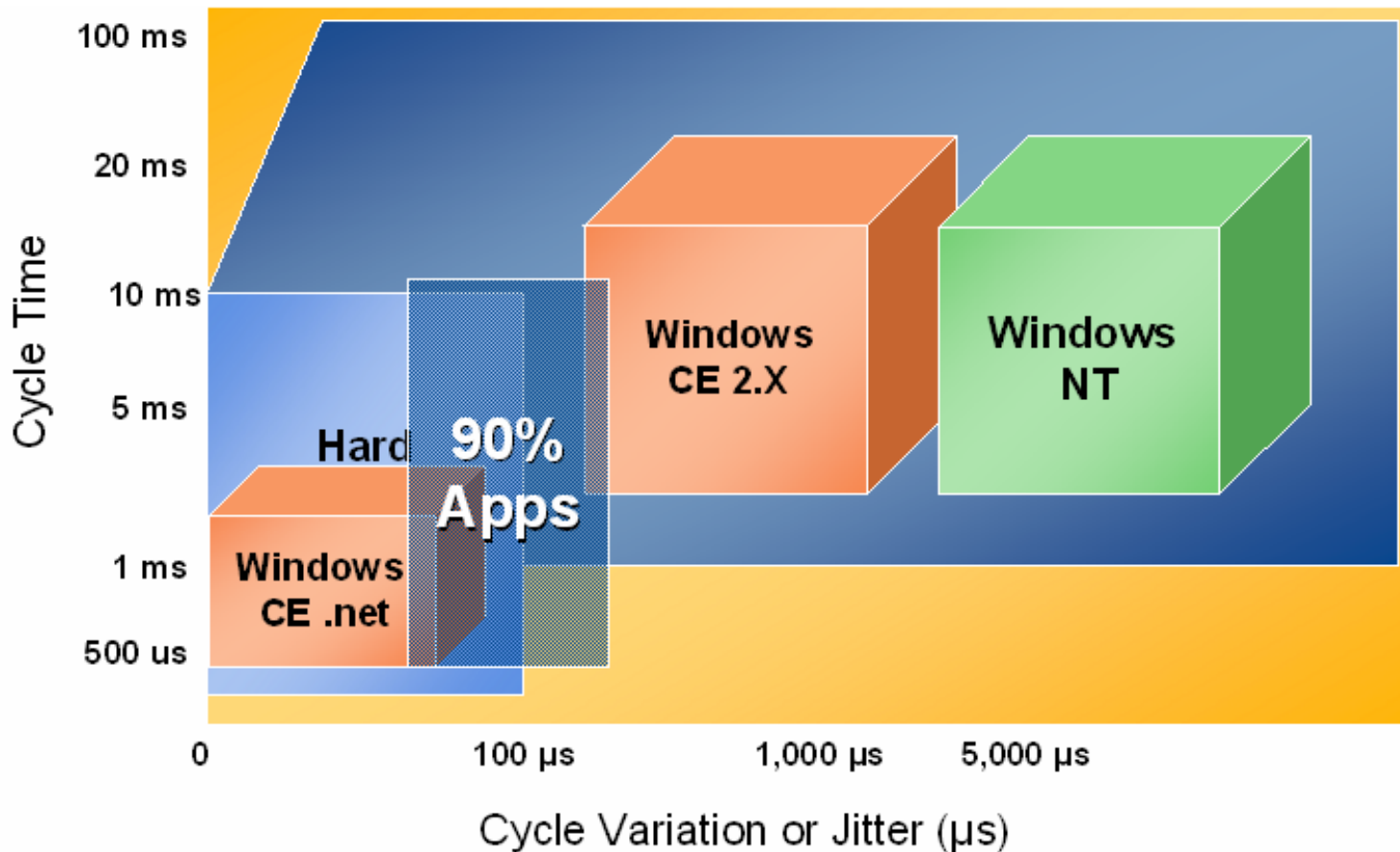
From OMAC (represents Industrial Automation Community)
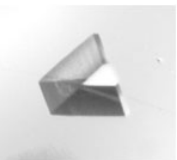
TINE Control System
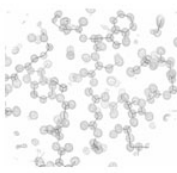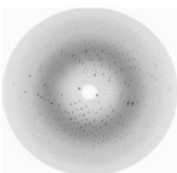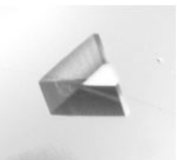
- Multi-Platform
- Multi-Protocol
- Multi-Architecture
  - Client/Server
  - Publisher/Subscriber
  - Producer/Consumer
- Strong language programming API
- Device Layer: CDI
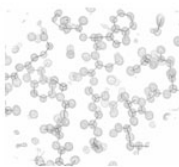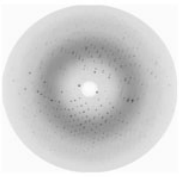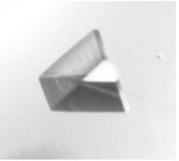- GUI Applications
- and much more…

TINE + Windows CE

- Cross-Compilation of TINE for Windows CE 5.0
- Migration of the code
  - Adaptation to the requirements of the Windows CE libraries
  - New MACROS
  - Just an example: WinCE uses UNICODE, TINE uses ANSI
  - Some functions used in TINE were not supported by WinCE (is a thin OS)
- Tools used:
  - VisualStudio 2005 and evC4 (free download)
  - Windows CE SDK (free download)
  - Windows CE emulator (free download)
- One compilation for every CPU architecture that wants to be supported

David Michael Ehlen © 2001
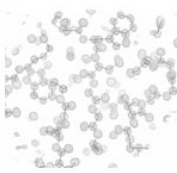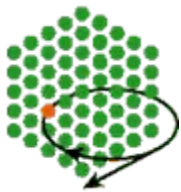
TINE + Windows CE

- **Current status**
  - TINE compiled for CPU x86
  - First simple server compiled in C
  - We are Debugging
- **Will came**
  - First stable release
  - CDI compilation
  - Compilation for other CPU architectures
  - Compilation for the new Windows CE 6.0 (alredy supported by Beckhoff)
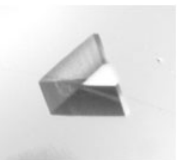 - JAVA servers & clients
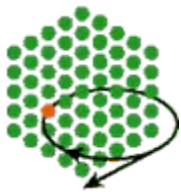
Application System

- Beckhoff Electronics
  - E
  - E
    - Analog Input/Output
  - Terminal Modules
   - Stepper Motor Controller
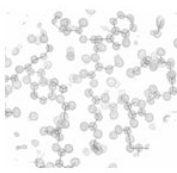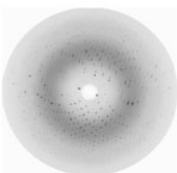
Application System

- Beckhoff Software: TwinCAT
  - PLC and Motion Control
  - Run-time system that executes control programs in real-time
  - Time-base, independently of other processor tasks
  - Direct access to the Hardware
  - Manage with the Windows CE OS
- Synchronization of all the HW in the PLC
  - cycle period of: XX us
  - On-fly scans of all signals
  - Synchronizated move of all the motors
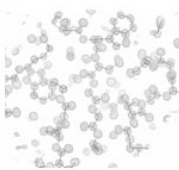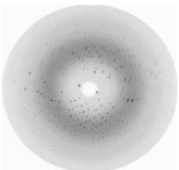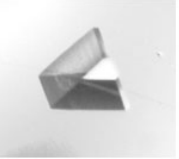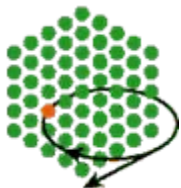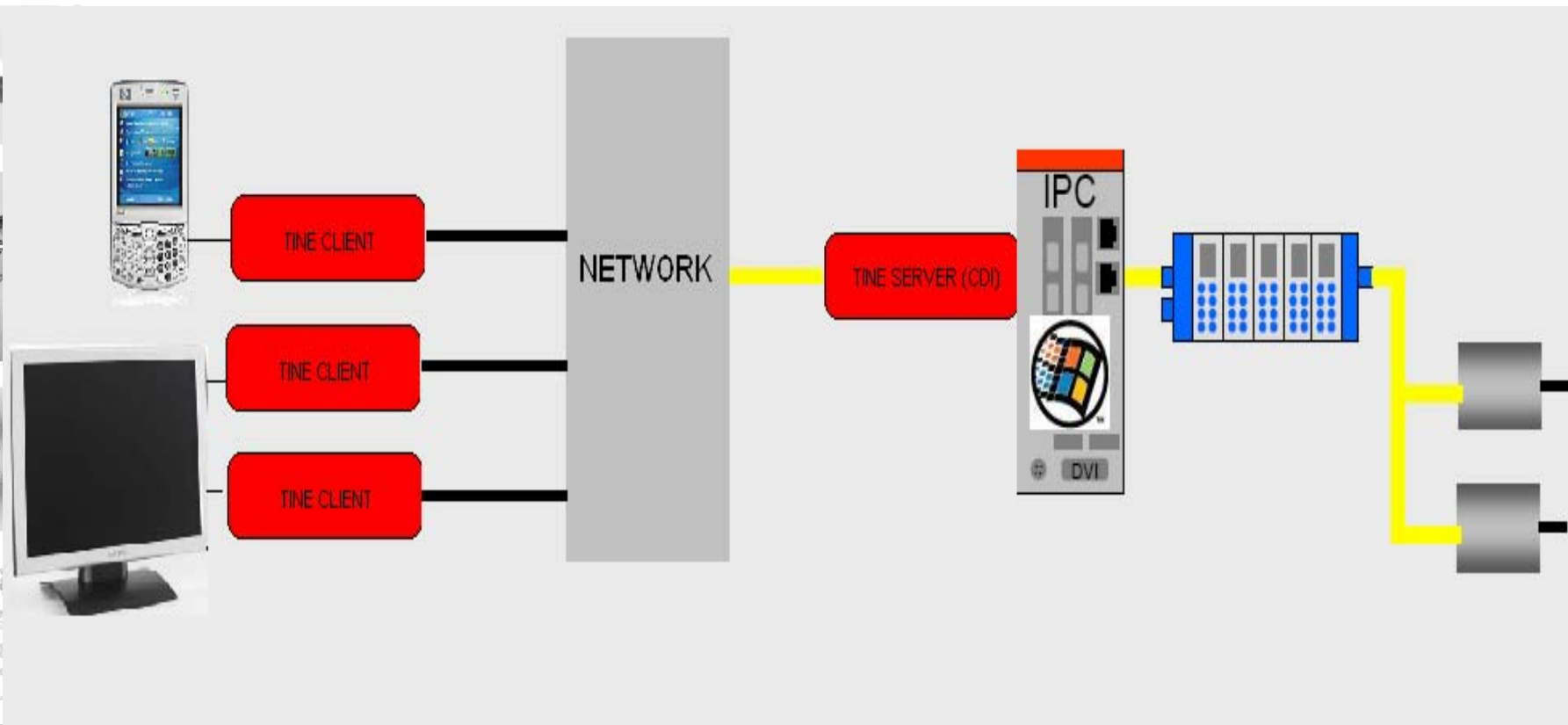
Stand-Alone System
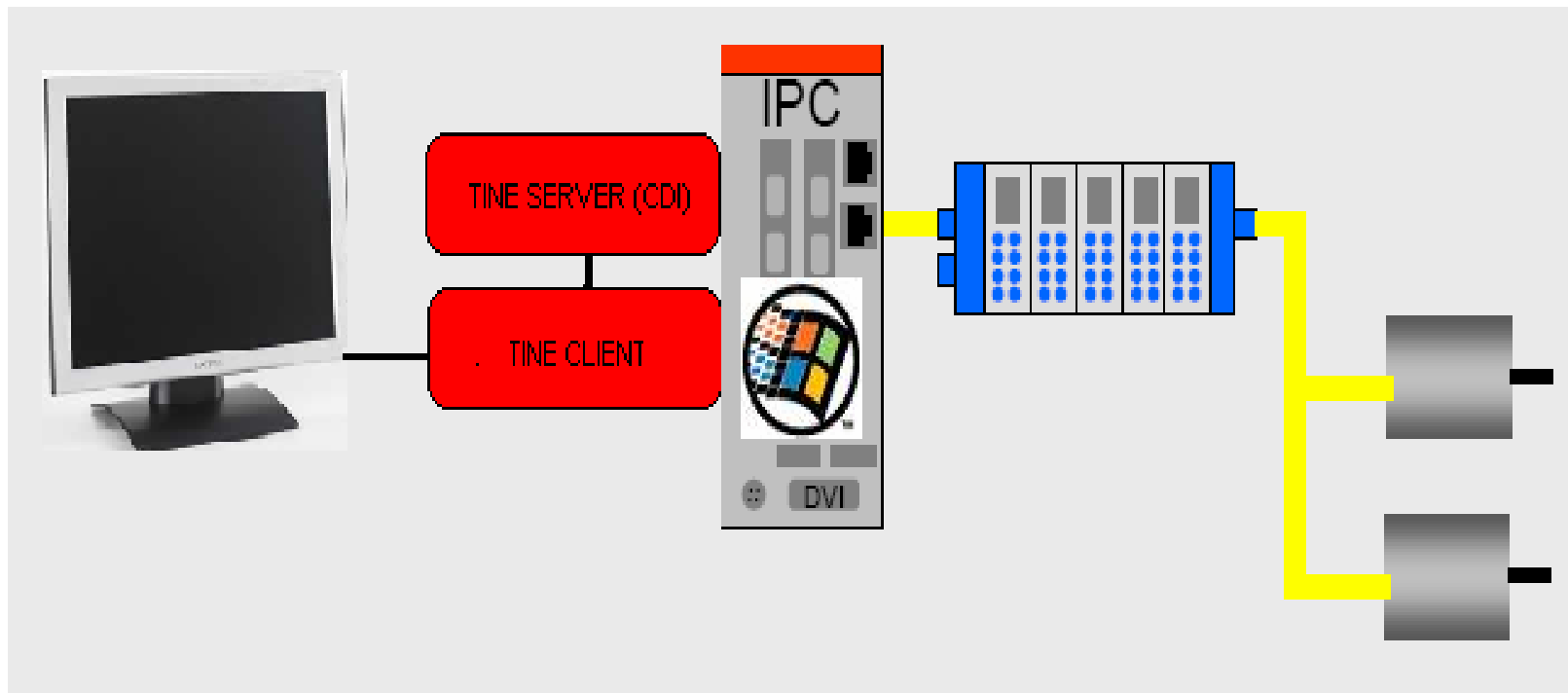
- CDI maps the HW giving an common interface
- TINE GUI Client (VC++,VB or Java)
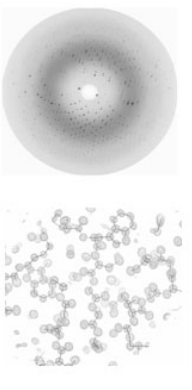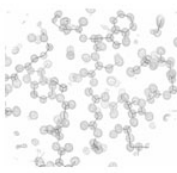
Control System Integrated

Conclusions
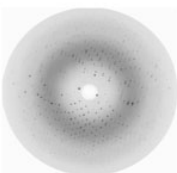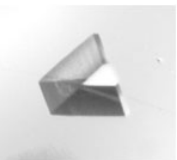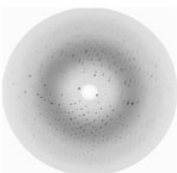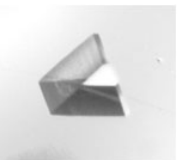
- First? Control System running under WinCE
- Real Time Capabilities
- New pogramming framework
- Final embedded system
- Make the server independent of the network
- More comming (Windows CE 6.0 just released)
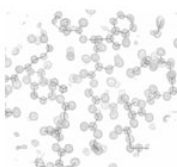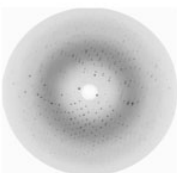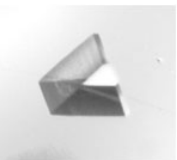- Big growing communitty (web, forums, …)

Acknowlegments

- EMBL Instrumentation group
  - Group Leader: Christoph Hermes
- PETRAIII Instrumentation group
  - Group Leader: Stefan Fiedler
- Philip Duval - DESY
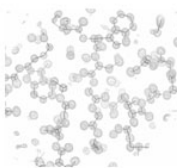
THANK YOU!!!

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