

Holonic Manufacturing & Controls

Concept Introduction



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Western Reserve Controls



Agenda

- Market background
- Trends
- Current Technology/Architecture
- Holonics
- Vision
- Opportunity



The Automation Market

- \$50,000,000,000+ world wide market
 - 3 major segments/technologies
 - Logic - primarily used in manufacturing plants
 - Automotive, packaging, material handling
 - Process - primarily used in fluid process plants
 - Power plants, chemical, petroleum refining
 - Motion - used everywhere
 - machining, electronics, entertainment



The Automation Market

■ Characteristics

- ~ 10 multi-billion \$ leaders
 - Rockwell, Siemens, Honeywell, ABB
- 100s of small, specialty companies under \$25M
- other than sales channels, not much in between
- Historically - proprietary, closed solutions



The Automation Market

■ Characteristics

- Much of the product supplied uses embedded, real-time, closed-loop software
- PCs are used for operator interaction and engineering interaction
- There tends to be a hard line existing between IT and controls community with little direct connection between the two



The Automation Market

■ Trends

- open networks
 - DeviceNet - logic
 - Fieldbus - process
 - SERCOS - motion
 - multiple variations of ethernet
- IEC standard for programming language
- lags commercial/IT practices
- Some attempts to merge motion/process/logic



The Automation Market

■ Issues

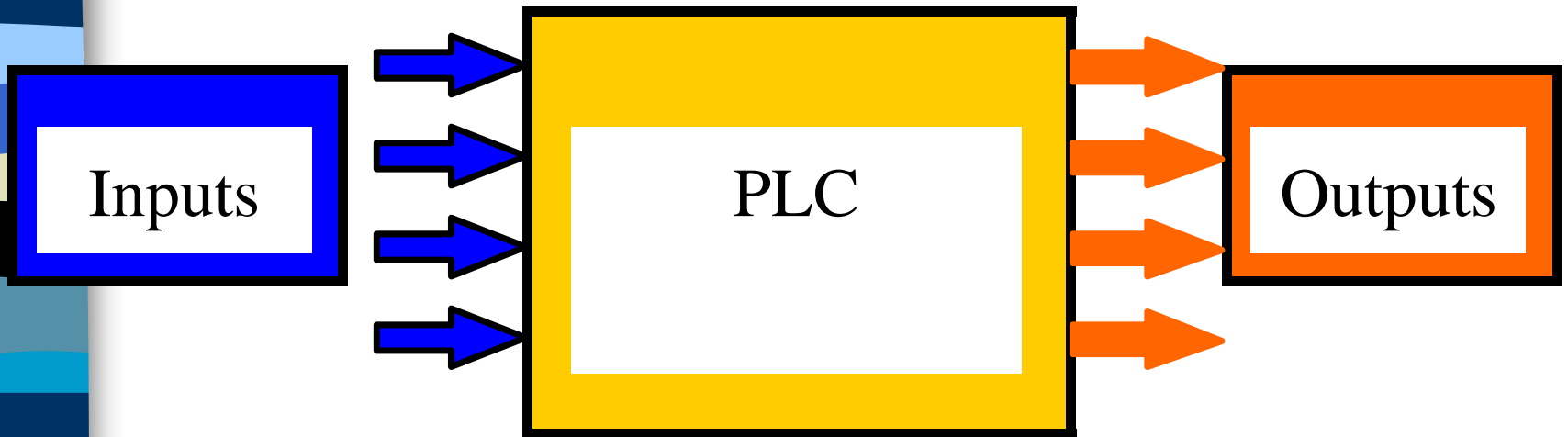
- product complexity vs. volume
- applications are potentially dangerous
- large vendors want to protect market position
- customers are betting their jobs and factories on their selection of vendors and technology
- **VERY CONSERVATIVE MARKET**



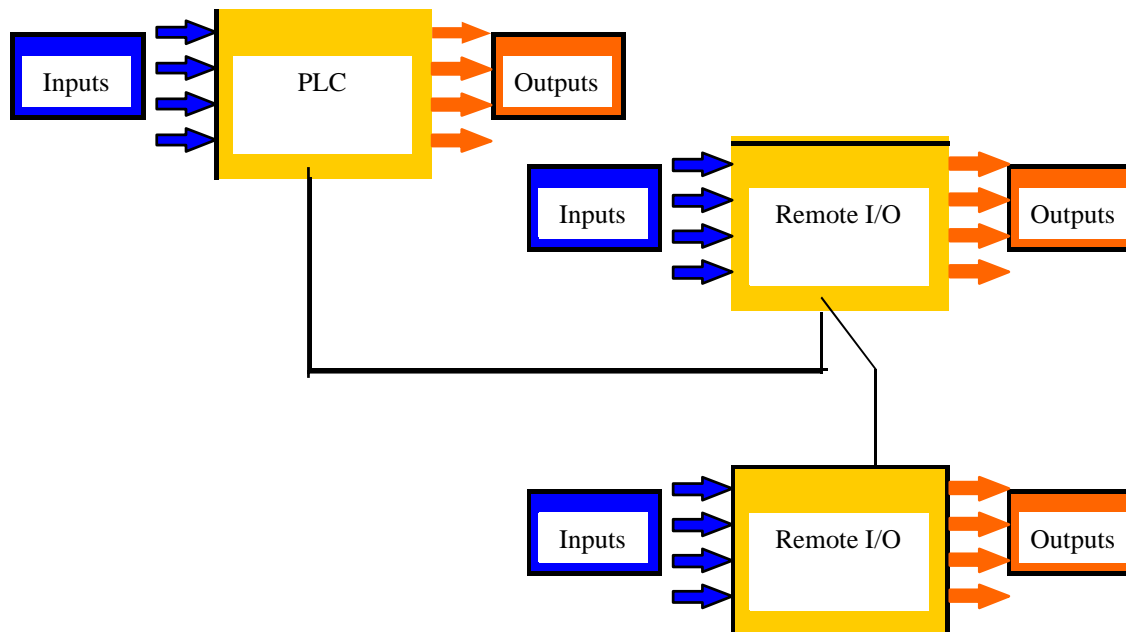
The Automation Market

- Today's Technology / Architecture
 - hierarchical
 - tends to centralize control for each plant area
 - think of it as a military structure - you do what your superior says, and no more
 - Vulnerable to unexpected events
 - Current manufacturing strategies exacerbate this vulnerability

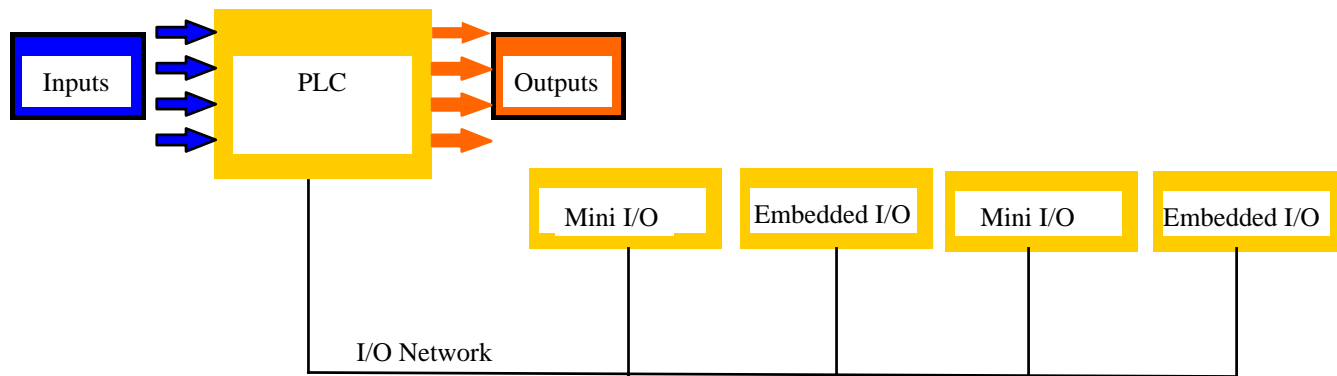
Automation Market - 60's



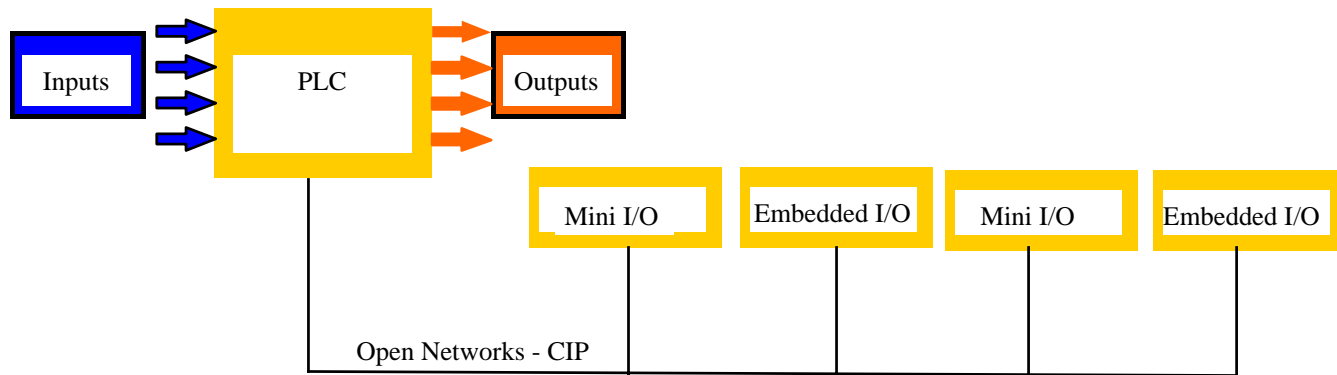
Automation Market - 70's



Automation Market - 80's



Automation Market - 90's





HOLONICS

- More than simply “automation”
- It is a production concept with specific ideals and objectives (auto perspective e.g.)
 - Guaranteed delivery 3-day car
 - Produce vehicles in low volumes at reasonable cost
 - Break dependency on scale and economies of scale

HOLONICS

IEC 61499

Parent organization: IEC

Working group:

TC65/WG6

Goal: Standard model
(function blocks) for
control encapsulation &
distribution

Holonic Manufacturing
Systems (HMS)

Parent organization: IMS

Working group:

HMS Consortium

Goal: Intelligent manu-
facturing through holonic
(autonomous, cooperative)
modules

↑ requirements
Controls architecture

↓ Agile systems architecture



HOLONICS

- Current control technology cannot meet these objectives
- Control technology by itself cannot meet these objectives
- This is the first major change in automation in 40 years
- The significance can be compared to the revolution comparing mainframe computers and the internet



HOLONICS

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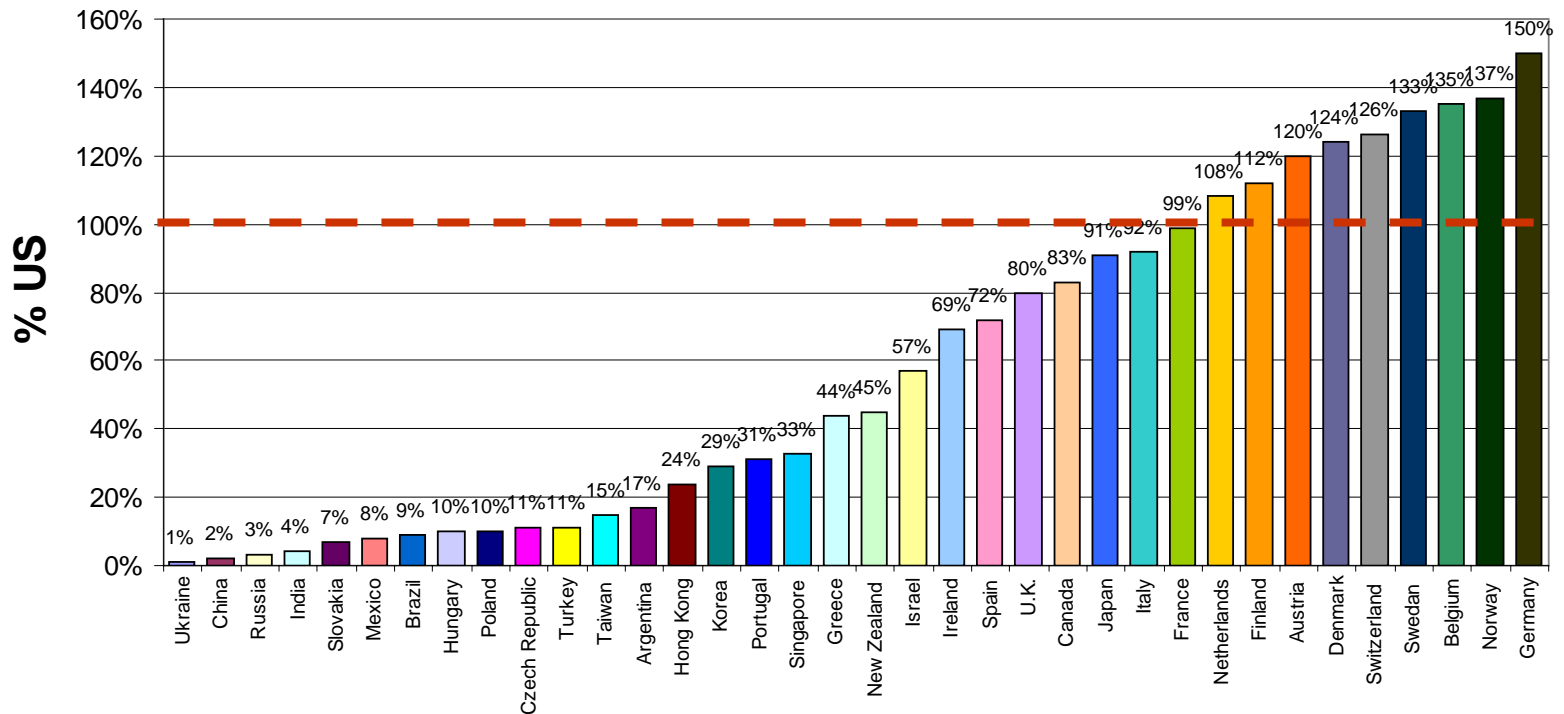


HOLONICS

- Think of the implications
 - competitive advantage is generated for local manufacturers
 - overseas labor cost advantages are contained
 - new industry/technology/services are created
 - local vendors are favored
 - new opportunities for small businesses

Meanwhile, OEMs are realizing the benefits of low cost labor countries

Labor Costs as a % US (Including Benefits)



Source: Economist Intelligence Unit Limited 1999
courtesy of Topworx Inc.



Global Wage Trends

The Next Low-Wage American Job

Average IT programmer salaries:

U.S.* -- \$75,000

Ireland -- \$23-34,000

Canada -- \$28,174

Israel -- \$15-38,000

China -- \$8,952

Philippines -- \$6,564

Russian Federation -- \$5-7,000

India -- \$5,880

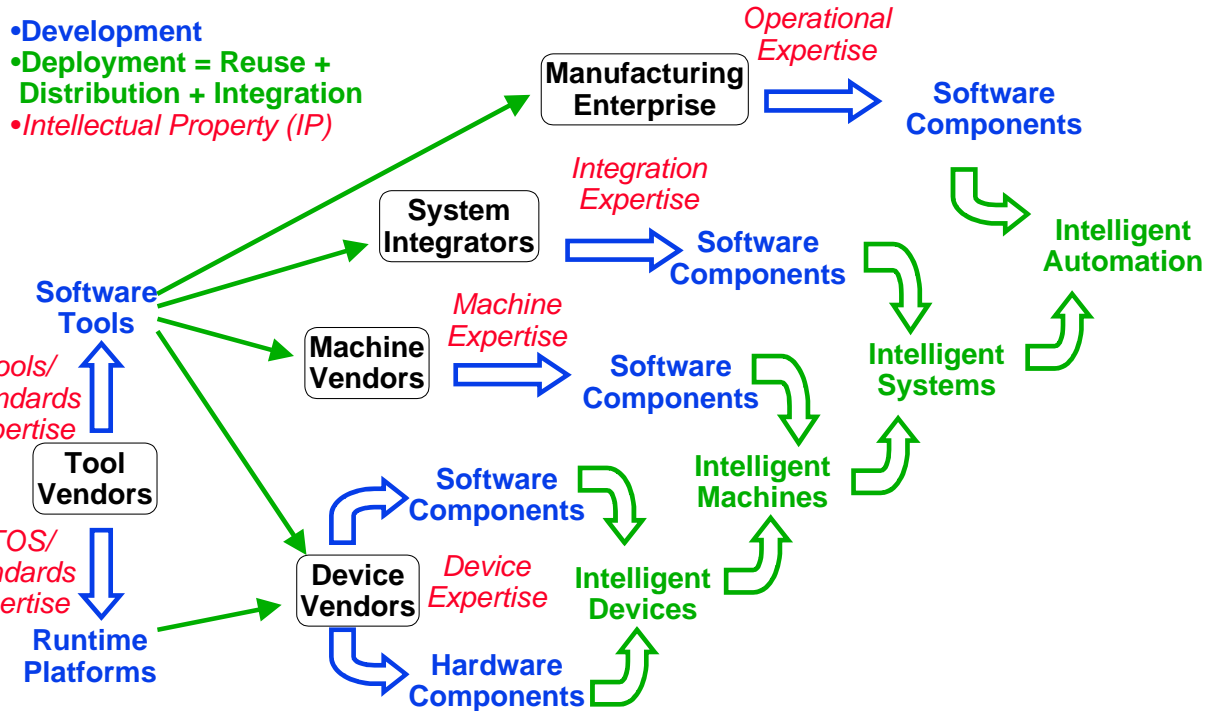
*"senior software engineer/developer/programmer"

HOLONICS

Rockwell Automation

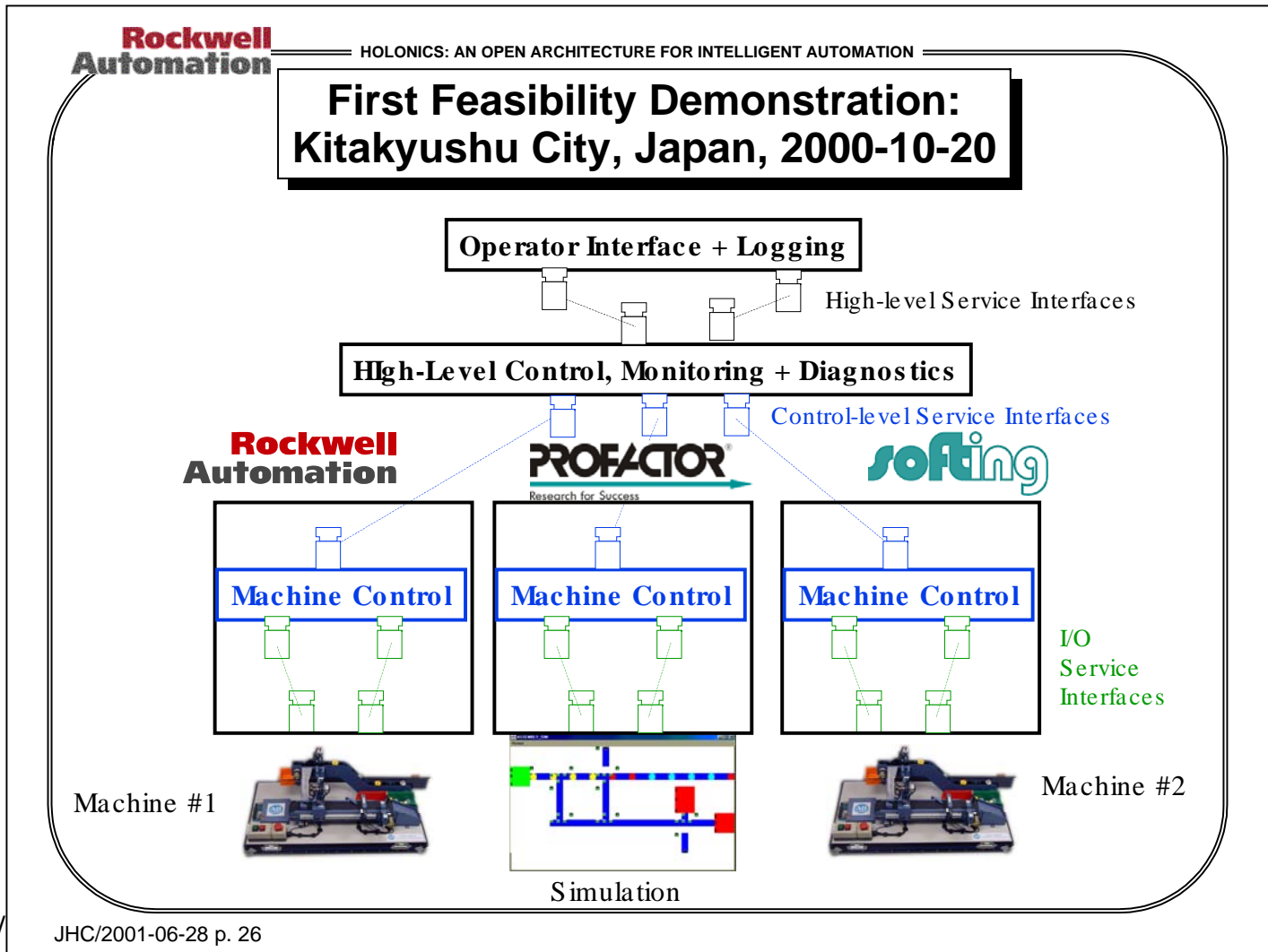
HOLONICS: AN OPEN ARCHITECTURE FOR INTELLIGENT AUTOMATION

Intelligent Automation: The IP Value-Add Chain

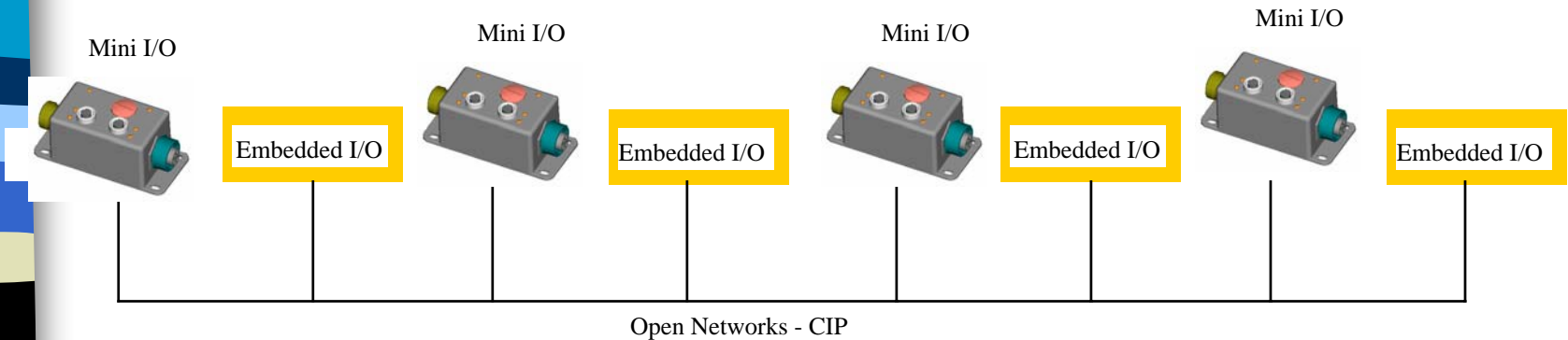


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HOLONICS



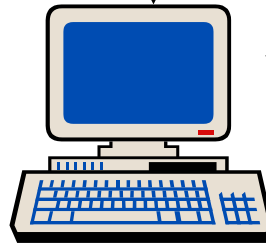
Automation Market - 2000's



Example Today

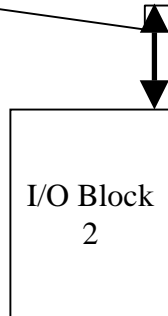


Ethernet

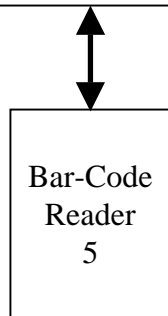


- Network Management
- Configuration
- Production Control
- Data Management
- Flexible Manufacturing Cell Management
- Device Management
- Production Scheduling
- Product Profile Management

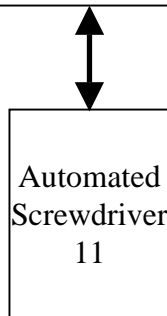
DeviceNet



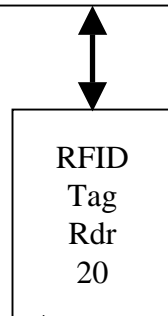
Interlocking
Material
Handling



Pallet
Identification



Automated
Fastening



Production
Part
Identification



Fastener
Type
Control



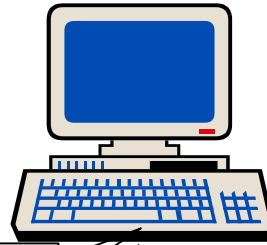
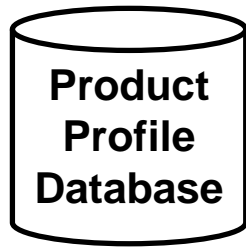
W5
OIB
21
Positioning
Interlock

Operator
Direction
&
Reporting

01/15/2004

Western Reserve Controls

Example Holonic



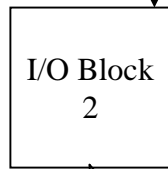
Network Management Configuration

Ethernet

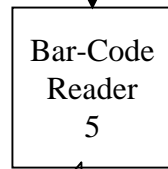


Ethernet/DeviceNet Gateway
Holonic proxies for dumb devices

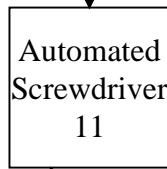
DeviceNet



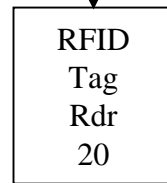
Autonomous Interlocking Material Handling via proxy



Pallet Identification



Automated Fastening



Production Part Identification



W5 OIB 21

Autonomous Fastener Torque Control
Product Profile Management



Autonomous Positioning Interlock
Production Scheduling

Autonomous Operator Direction & Reporting
Device Management



HOLONICS

- The concepts have been in the research arena for the last 10 years
- The technology obstacles have been resolved, build upon current software technology, and an IEC standard has been issued
- European and Japanese companies seem to be pursuing the technology aggressively
- The technology is to automation what the internet was to mainframe computing



Useful URLs

- General Information:

- <http://www.holobloc.com>
- <http://www.holobloc.com/fbdk/README.htm>

- IEC 61499 and 61131-3 related:

<http://www.holobloc.com/stds/iec/sc65bwg7tf3/html/news.htm>

- HMS Consortium:

- <http://hms.ifw.uni-hannover.de/>

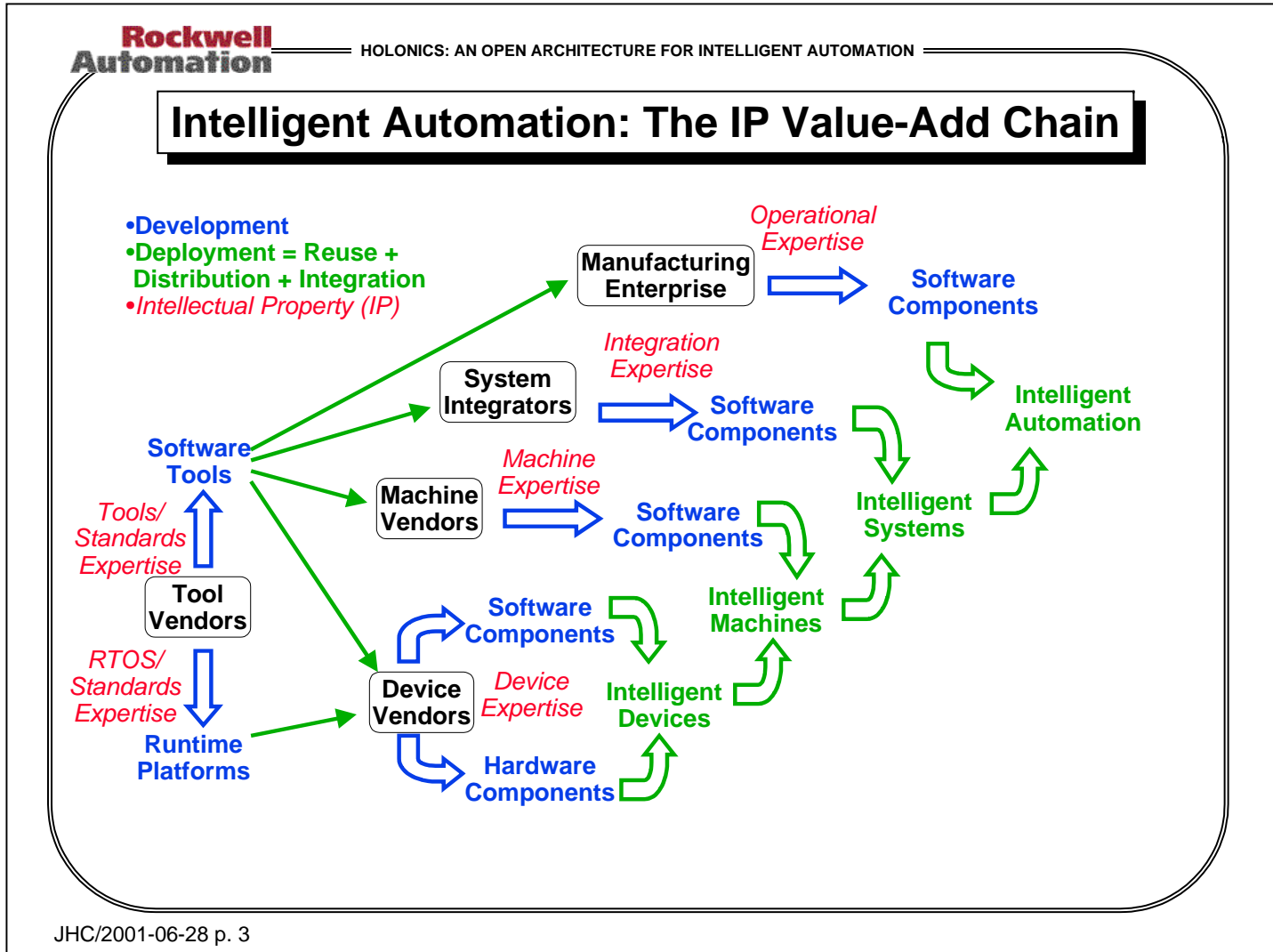
- FIPA: <http://www.fipa.org>

- HCD proposal: <http://www.holobloc.com/stds/fipa/hcd/>

- OOONEIDA CCI

- <http://www.oooneida.info/>

HOLONICS





OPPORTUNITY

- Investment to jump start the technology
- Participation
 - automation tools
 - target market
 - OEM with proprietary technology to embed
 - Beta site/collaborator
 - Automation Object Repository - OONEIDA
 - The Silicon Valley of Holonic Manufacturing?
- Interest?
 - Jimb@wrcakron.com
 - 330-733-6662