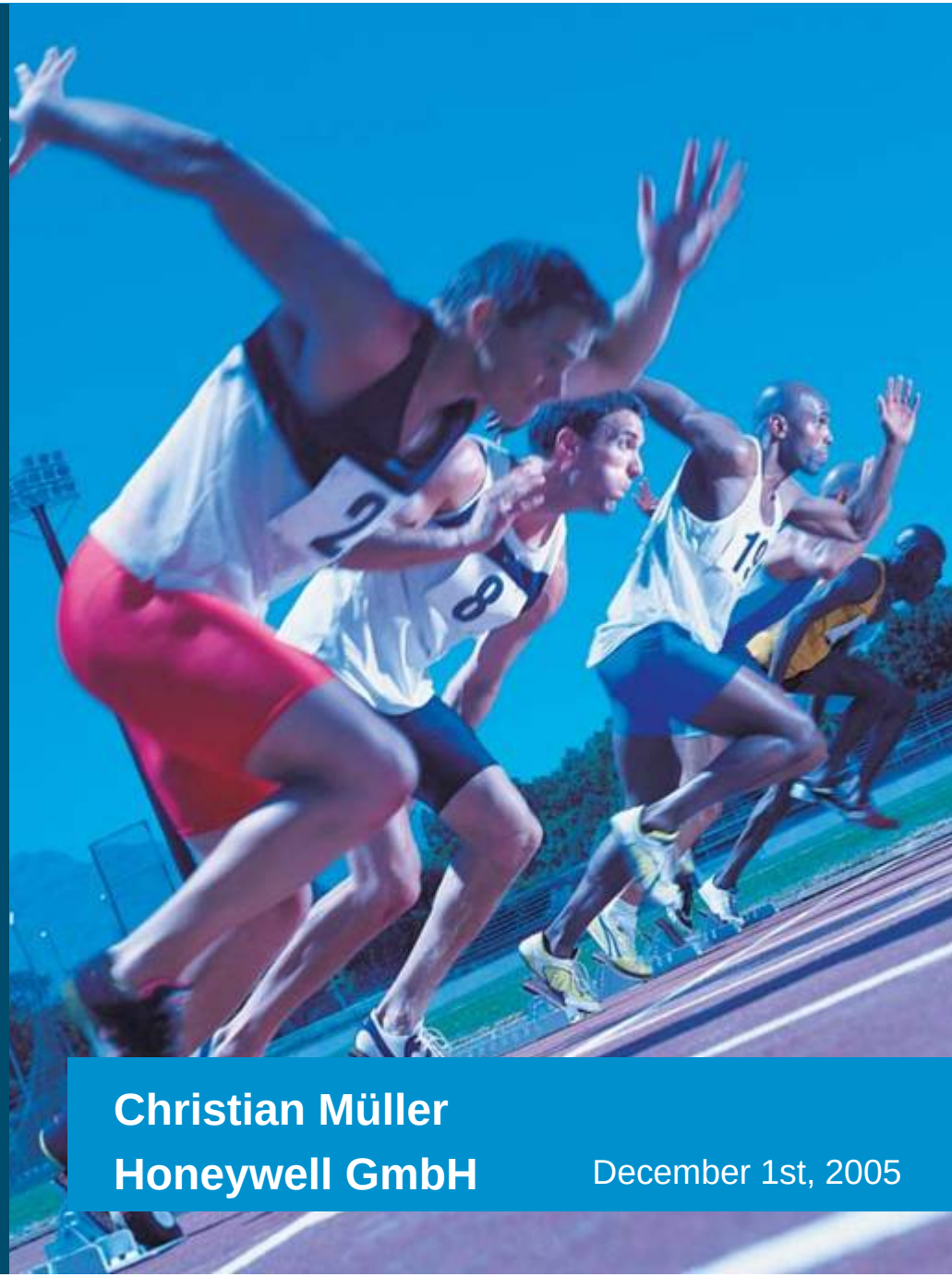
BACnet FORUM 2005

BACnet on the move

Standards in building management

Similarities and differences of BACnet, OPC und LON



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Why integrate?

- Drill down operating cost through a single BMS
  - Combine heterogeneous HVAC-control islands
  - Integrate legacy DDC-system generations (migration)
  - Single, homogenous user interface
    - Cross functional management of Fire & Security and HVAC control
    - Integration of further automation systems (chillers, lifts, ..)
  - Increase comfort, lower energy consumption
  - Integration within the room (lighting, blinds, HVAC control), primary control, metering, energy management, access control, smoke exhaust
- Assign energy cost to users in a transparent way
  - Metering (electrical energy, water, ...)

Why integrate?

- Lower cost for software maintenance of different management systems
- Reduce space required for control rooms, thus increase useable floor space
- Reduce staff required to control the installed technical systems
- Improve the flow of information
  - Allow for data exchange with ERP-systems
- Allow for inter-system functionality
  - Provide more/better information in case of a alarm
- Less cabling
  - Make use of structured, standard cabling
  - Reduce fire load and space required for cable routes

Various protocols for building automation

- Thesis
  - Today there is no single communication protocol for building automation that provides optimum performance in solving both technical and commercial requirements
  - In order to solve integration tasks, it makes sense to use proven, open and standard communication standards
    - ISO, EN, DIN-standards (BACnet, LonMark, KNX/EIB)
    - Proven industry standards (OPC, ...)

Building Automation Standardization

- CEN TC 247

Norm	Description	Protocol
EN ISO 16484-5	Data Communication Protocol	BACnet
EN 50090	Home and Building Electronic System	Konnex (KNX)
EN 14908	Control Network Protocol (CNP)	LonWorks

Effect on the market

- Guidelines for construction in Europe
  - The Guidelines refer to concrete CEN-norms when it comes to specification of the requirements for communication between building automation products
  - In order to get the CE-approval, products need to pass a conformance test
  - Future tenders will require products that have one of the three standards implemented (BACnet, CNP or KNX)
    - Only applies for products with a communication interface
  - In future products that do not meet the European norms, must not be used!

BACnet history ...

• 1987	• Foundation of the ASHRAE (American Society of Heating Refrigeration and Air-Conditioning Engineering) committee SPC135. Team charter: Development of a communication protocol which would be neutral and allow monitoring, control and energy management within buildings.
• 1991	• First draft version of the new protocol available
• 1995	• BACnet published as ASHRAE 135-1995 and ANSI standard
• 1998	• BACnet becomes EN 1805-1 and ENV13321 by CEN TC247
• 2001	• FND withdrawn by CEN as ENV
• 2002	• ANSI/ASHRAE 135-2001 published
• 2003	• BACnet to become ISO norm as the only BMS-protocol
• 2004	• First BACnet devices tested for conformance in Europe

What is BACnet good for?

- BACnet is a communication standard that allows for data exchange (including complex data) between systems from various vendors
- BACnet allows for interoperability of devices and systems from various vendors
- BACnet is most suited for
  - HVAC control applications (in Europe integrations on management and automation layer) but also
  - Integration of life safety systems

What can BACnet provide?

- BACnet does provide standards for transactions like:
  - COS/COV
  - alarm/event handling supporting alarm/event priority
  - historical data
  - data access control
  - command priority
  - file transfer
  - save/restore of programs
  - calendar and scheduling functionality

Why BACnet?

- BACnet ...
  - is independent from specific hardware or operating systems
    - This helps to protect customer investment as technology keeps changing
  - is an ISO standard
  - does not require any licence cost
  - supports multiple network options (including IP)
  - includes standards also for complex transactions and communication requirements
  - has got a strong track record of projects done
  - receives support from multiple vendors, thus allowing competition
  - does not only support HVAC control applications, but also security and life safety applications
  - PICS allows to compare the communication behaviour of applications and products in a standard way

The birth of OPC ...

OPC introduction

- The task:
  - Get data from a PLC into an Microsoft based application within a PC-based network.
    - Prior to OPC a special driver needed to be written and maintained for each protocol that had to be integrated into a visualisation (SCADA system)
  - Target:
    - Provide a standard interface with standard objects (OPC server) that every PLC-vendor could integrate and that could also be integrated by every vendor of visualisations (OPC client)
    - Provide a standard interface between plant control level and information technology

The history of OPC

- 1989
  - PC-based SCADA systems used the DDE interface to access process peripherals
- 1995
  - Due to performance limitations, the companies Fisher-Rosemount, Intellution, Intuitive Technology, Opto32, Rockwell, Siemens and Microsoft formed the OPC Task Force.
  - OLE for Process Control (OPC)
- August 1996,
  - the first OPC specification was available (OPC version 1.0).
- September 1996,
  - foundation of the “OPC Foundation”
- October 1998,
  - version 2.0 of the Data Access specification.
- January 1999,
  - Alarm and Event Specification 1.01
- 2001
  - roll out of the Compliance Testing und Certification Program
- Today more than 300 companies are member of the OPC Foundation, 40% of the members come from Europe.

OPC introduction

- OPC (OLE for Process Control) is a Client-/Server Software Interface, based on the Microsoft COM / DCOM technology
  - COM - OPC server and client are hosted on the same machine
  - DCOM - OPC server and client are hosted on different machines that communicate over the network
- Because there are no optional object properties, OPC communication in principle can be „Plug & Play“, if the network is set up properly
  - DCOM configuration in a complex network environment is tricky
  - OPC/DCOM communication requires port 135 to be open, but this port is normally not available with firewalls because of potential data security issues (virus like W32.Lovsan).
- The upcoming Microsoft OS VISTA will require OPC solutions to migrate to .Net (cost issue).

OPC class model

- OPC-item
  - An item is used to access data like:
    - Sensor values (temperature, smoke, ..)
    - Actuator values (start, stop, open, close, ...)
    - Device status information
  - OPC item “Quality information”
    - Information whether the item value origins from the field
  - OPC item “Time information”
    - Informs by when the value had been measured
  - Each item can be assigned properties lie range, engineering units, ...
- Within an OPC server OPC groups are defined that contain OPC items to be handled in a similar way
  - Periodical transmission
  - COS/COV transmission

OPC specifications

- OPC Data Access
  - Used to move real-time data from PLCs and other control devices to HMIs and other display clients. Standard on the market is OPC DA 2.05.
- OPC Alarms & Events
  - Provides alarm and event notifications on demand (in contrast to the continuous data flow of Data Access).
  - OPC Clients can subscribe for alarms and events from the OPC server.
- OPC Data eXchange
  - This specification takes OPC from client/server to server-to-server with communication across Ethernet field bus networks.

OPC specifications

- OPC Historical Data Access
  - Where OPC Data Access provides access to real-time, continually changing data, OPC Historical Data Access provides access to data already stored.
- OPC Security
  - OPC Security specifies how to control client access to these servers in order to protect this sensitive information and to guard against unauthorized modification of process parameters.
- OPC XML-DA
  - OPC XML-DA is developed to expose plant floor data using XML and SOAP. Specification still under development.

Need more information?

- OPC Foundation web pages
  - www.opcfoundation.org
- OPC European member web pages
  - www.opceurope.org

BACnet/OPC comparison

- **BACnet**
  - Specifications/Profiles
    - Data Sharing (with priority)
    - Alarms and Events
    - Historical Trends
    - Scheduling
    - Device and Network Management
    - Access Control mechanisms build in
    - BACnet via XML
      - Specification in public review
  - Conformance tests
    - Basic European BACnet conformance tests

- **OPC**
  - Specifications/Profiles
    - Data Access (DA)
    - Alarm & Events (AE)
    - Historical Trends
      - only few implementations
      - Normally done on SCADA level
    - Scheduling
      - needs to be done on SCADA level
    - Access Control
      - available. Only a few implementations make use of OPC Security
    - OPC XML-DA
      - spec. under development)
  - Conformance tests
    - Compliance Tests available through the OPC Foundation

BACnet/OPC comparison

- **BACnet**
  - Planning and Start-up
    - BACnet is not Plug & Play f. e. due to optional object properties
    - A deep comparison of the PICS is required
    - Test installation recommended
    - Binding:
      - Data documentation can be exchanged via standard EDE-Format or
      - BACnet solutions often allow for address space browsing
- **OPC**
  - Planning and Start-up
    - OPC allows for Plug & Play if the network is correctly been set up.
    - No optional object properties
    - Configuration of DCOM in complex network environment can be tricky.
    - Many times firewalls do not allow to open port 15 (OPC/DCOM) because of potential virus attacks (like W32Lovsan)
    - Binding:
      - OPC solutions often allow for address space browsing

BACnet/OPC comparison

Characteristics	BACnet	OPC
Peer-to-Peer data exchange	yes	No (yes: OPC-Data exchange)
Event oriented data transmission	yes	yes
Polling	yes	yes
Scheduling	yes	no
Online grouping	yes	yes
Trend support	yes	no
Build in Alarming	yes	yes (OPC-AE)
Backup/Restore	yes	no
Ethernet/IP support	yes	yes
Large product offering	(yes)	yes
Zero engineering	no	no

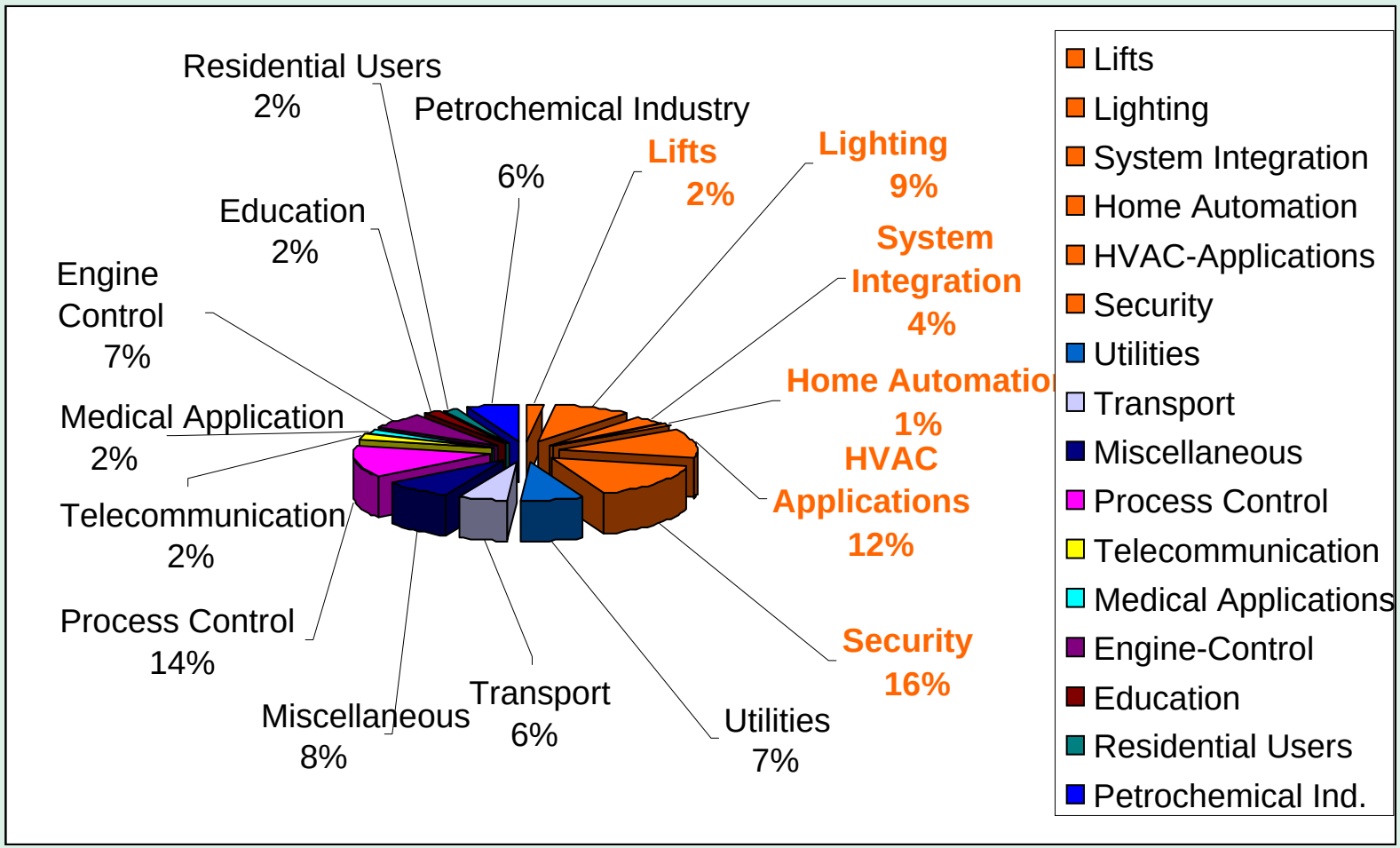
BACnet and OPC complement each other

- BACnet is most suitable, if it comes to ...
  - Building Management applications (alarming with acknowledgement, scheduling, save and restore of application programs, command priority, Peer-to-Peer data communication)
  - Data exchange between devices (e. g. an energy management application requires data from various DDC systems on the LAN for peak load control)
- OPC is best suited, if it comes to ...
  - Simple data exchange between a SCADA system and a PLC or integration of a fire panels into a Visualisation
  - Data exchange with IT- or ERP (Business) applications

LonWorks

- Technology Partner: Echelon (San Jose, USA)
  - Platform to design and engineer decentralized automation networks that can be used in various industries
- LonWorks history
  - 1986 beginning of the development works
  - 1990 first introduction of the Neuron Chip
  - 1991 the Neuron Chips starts selling
  - 1993 foundation of the German LON-Nutzer-Organisation e. V. (LNO)
  - 1994 The LonMark Interoperability Association rolls out the first set of standards for interoperability of application
  - 1996 Announcement of the LNS architecture
  - 1997 Introduction of LNS
  - 1998 ... Development and sales of tools, hardware and applications

Building Automation and Control applications count for 45% of all LON applications worldwide



LonWorks

- LonWorks BMS applications focus on:
  - Room automation (HVAC control, blinds, lighting) including primary control
  - Fire damper monitoring
  - Metering
  - Access control
- Interoperability through LonMark certification
  - Vendors test their products using LonMark checklists (self declaration)
  - LonMark checks the product documentation including XIF files
  - There is still room for proprietary (vendor specific) extensions

LonWorks - terms

- LonMark™
  - Is the trademark and symbol of certification of the LonMark Interoperability Association (more than 200 members).
    - Standard for interoperability of LonWorks nodes
    - Self documentation of LON-nodes
    - Standard configuration

(http://www.lonmark.org)

LONMARK™ SPONSOR

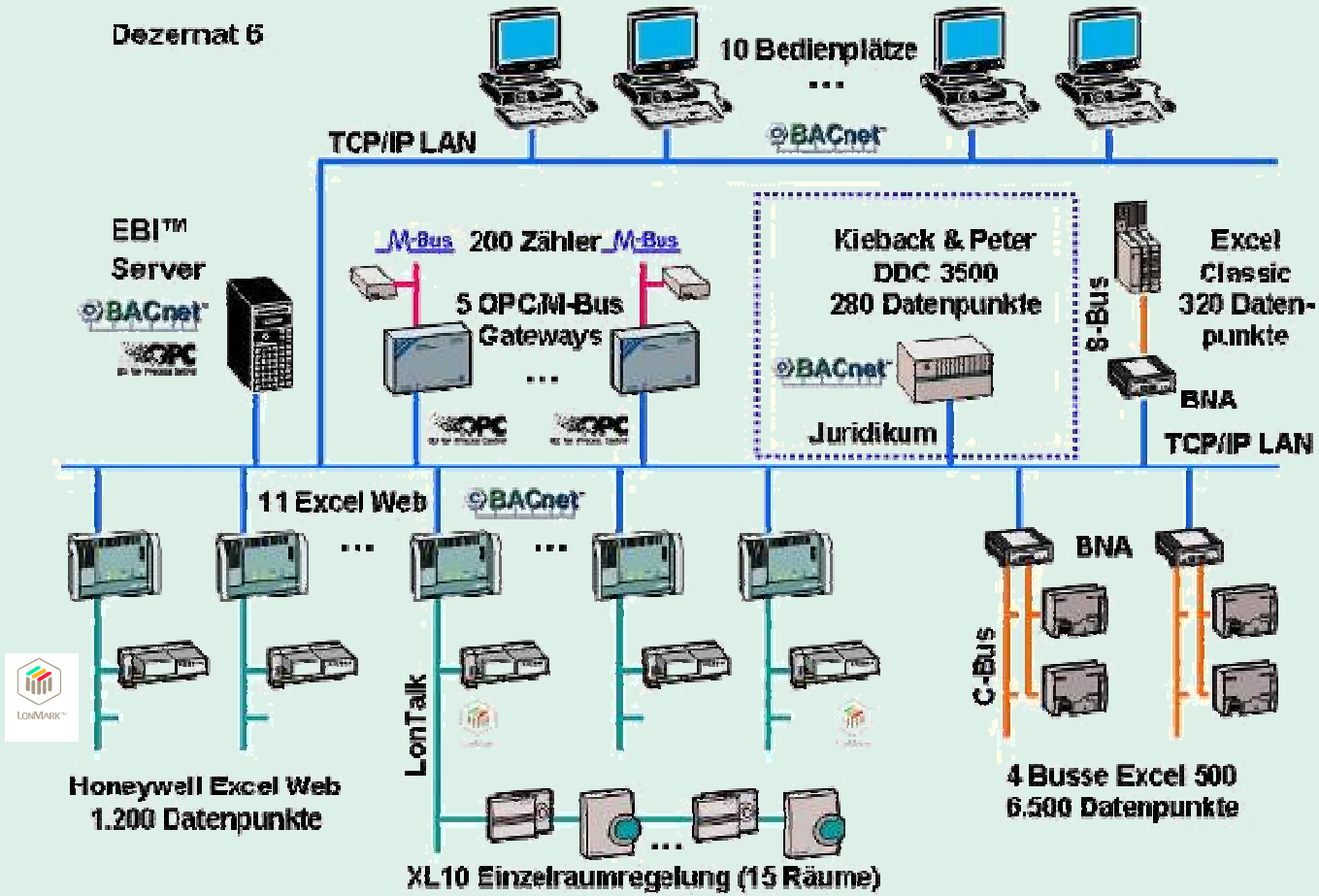
LonWorks/BACnet comparison

Characteristics	BACnet	LonWorks
Peer-to-Peer data exchange	yes	yes
Event oriented data transmission	yes	yes
Data transmission by polling	yes	yes
Scheduling	yes	no
Online grouping	yes	no
Trending	yes	no
Alarming	yes	no
Backup/Restore	yes	no
Support Ethernet/IP	yes	yes
Large product offering	(yes)	yes
No engineering required?	no	no

LonWorks

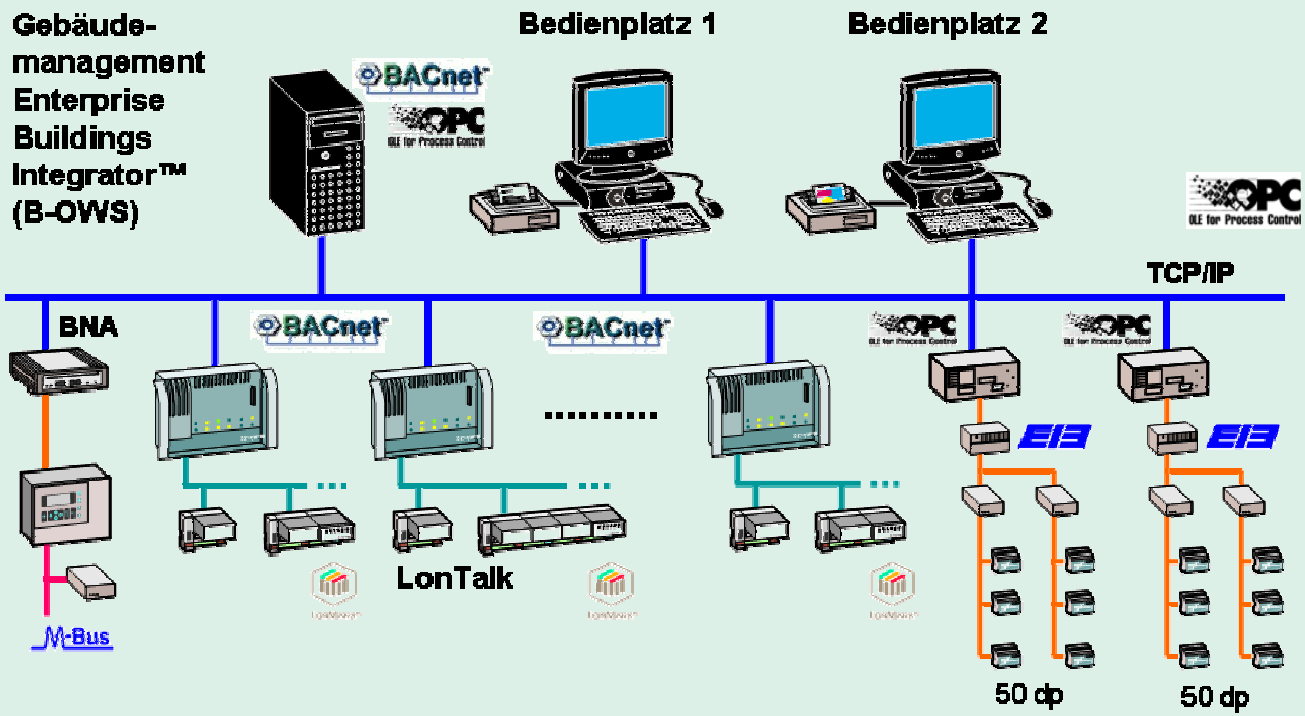
- Advantages
  - Decentralized architecture on automation and field layer
  - Interoperability of functions and devices through LonMark profiles
  - LonWorks devices are being used worldwide and are available from various vendors
  - LonTalk/IP support allows to integrate LON in an IP-environment
  - Positive project experiences
  - Huge know how available with system integrators and consultants
- Limitations
  - Management-functionality like alarming, scheduling, trending
  - Requires license fees

Integration at University of Düsseldorf



Integration at a German football stadium

Gebäudemanagement Frankenstadion, Nürnberg

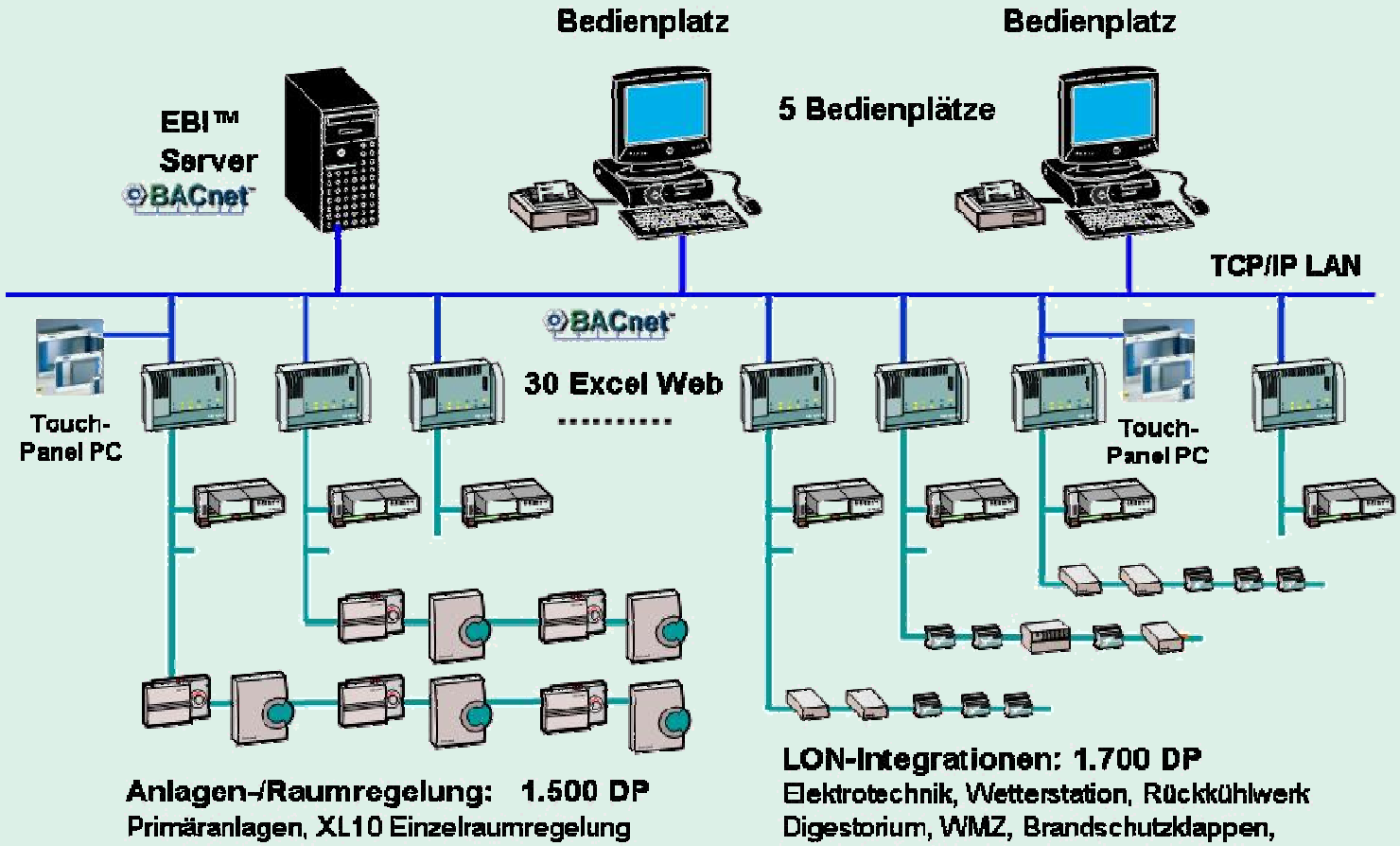


M-Bus Zähler
-Stadionbad
-Wärmezentrale

11 BACnet B-BC
Automations-
stationen

Beleuchtung
-Max-Morlock-Stuben
-Funktionsgebäude

Max-Planck-Institute, Tuebingen



More BACnet project examples …

- VW Wolfsburg facility
  - B-OWS and 9 B-BC (Excel Web), metering application
- US Army Base Grafenwöhr
  - Excel Web linked to Citect SCADA via OPC
- Würth (Industrial customer)
  - Excel Web linked to SCADA system via OPC
- Technology Compound of the German Parliamentary Buildings, Berlin
  - 109.000 datapoints, Honeywell B-OWS interfacing
    - Kieback & Peter, ABB, JCI, AutomatedLogic, SAIA, Honeywell Excel Web
- Munich Airport, Airfreight Control Center,
  - Siemens VISONIK integrated via BACnet (5.200 dp)
- Berlin Trade fair
  - Siemens VISONIK integrated via BACnet, (5.800 dp)

Questions from your side?

Thank you!