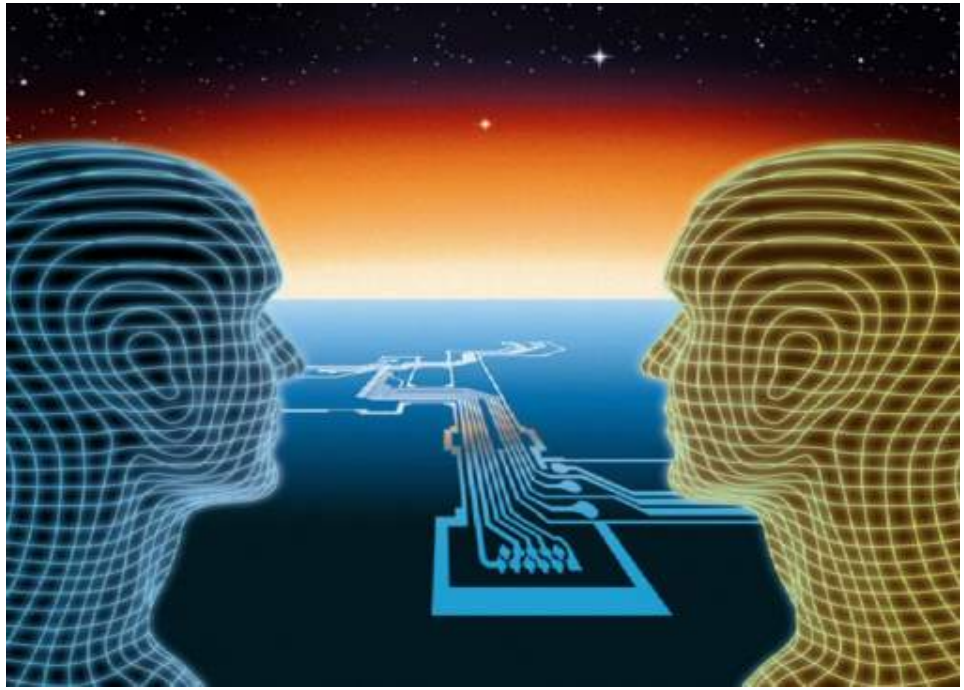
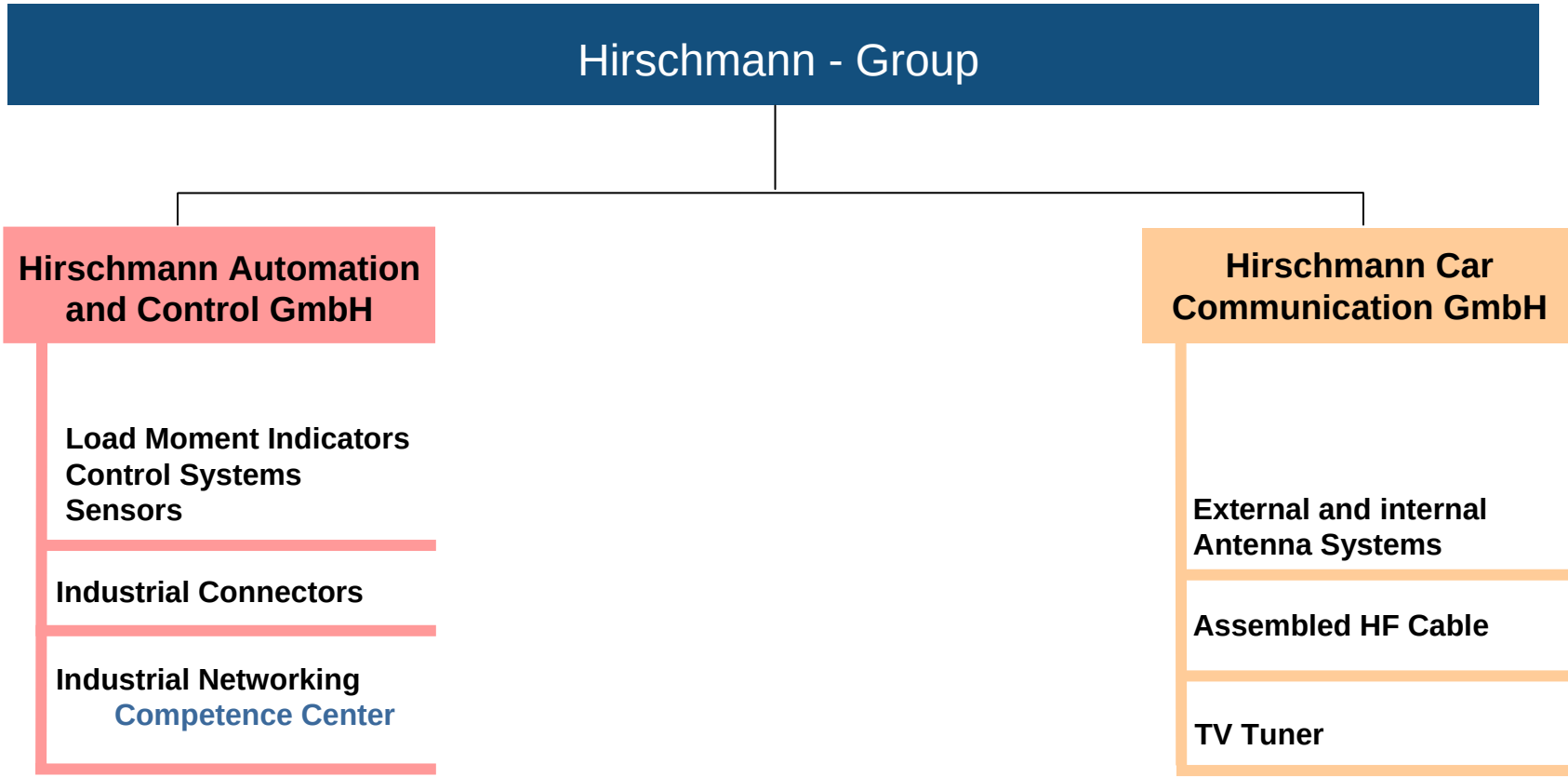
Design of Modern Industrial Networks

The Current Trends



Hirschmann Automation and Control GmbH
Thomas Schramm

Divisions of the Hirschmann Group



Industries

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Automation

Process

- Chemical
- Metal
- Power Generation
- Power Distribution
- Water/Waste Water
- Oil & Gas, Petrochemicals

Factory

- Conveyors
- Machinery
- Food & Packaging
- Paper & Printing
- Automotive
- Shipbuilding

Transport

- Railways
- Airports
- Pipelines
- Civil Engineering

Consulting

- Consultation
- Design
- Project Management

Training

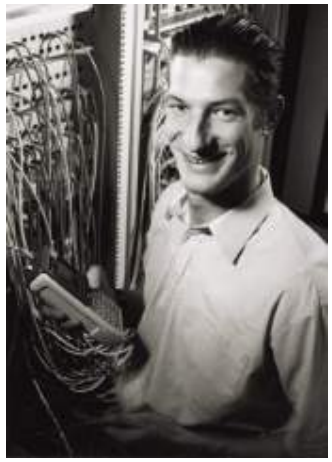
- Technology training
- Product training
- User training

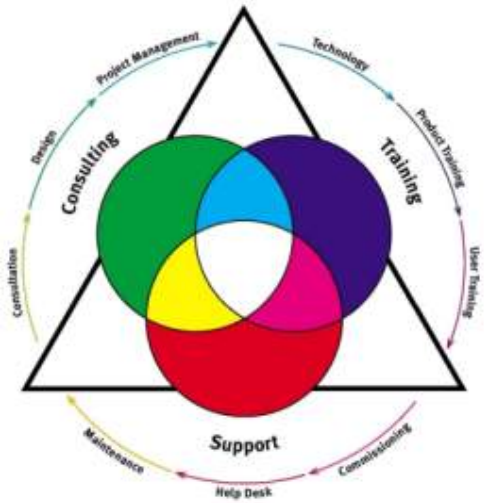
Service Expertise Made to Measure

- Comprehensive and Individual -

Support

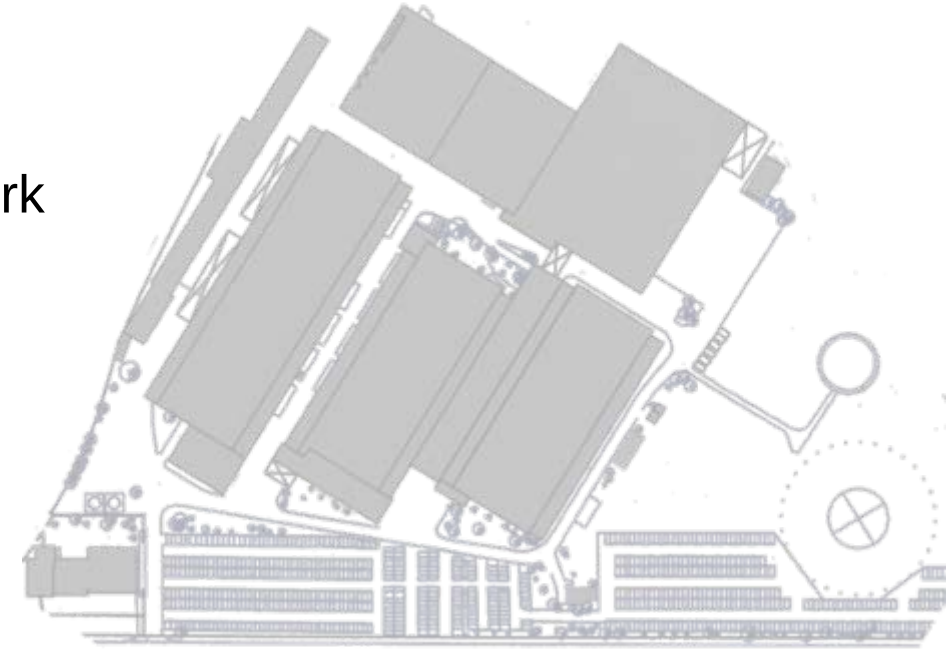
- Commissioning
- Help Desk
- Maintenance





Ethernet Company

- 2,000 users
- 3,000 IP addresses
- 50,000 m²
- Fibre cable > 1,000 km
- Changing and expanding of network components during live operation
- High temperature requirements
- High EMC requirements
- End-to-End management
- Redundant network design
- Expandable
- Easy diagnostics



Site Plan

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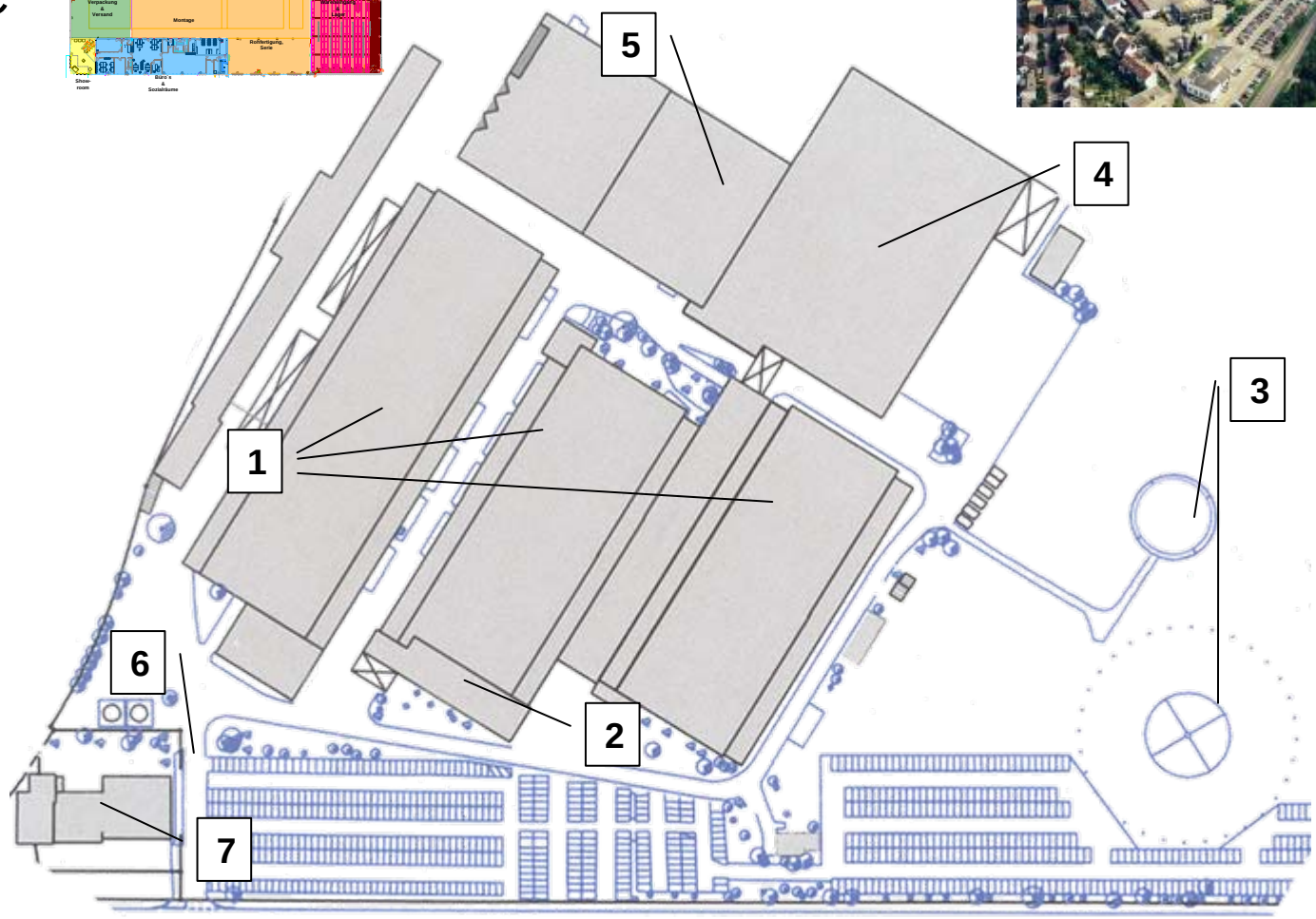
1. Building A, B, C
2. Head Office
3. Test area
4. Stores
5. R&D / Sales
6. Front gate
7. EMC building



Demands of a modern industrial network

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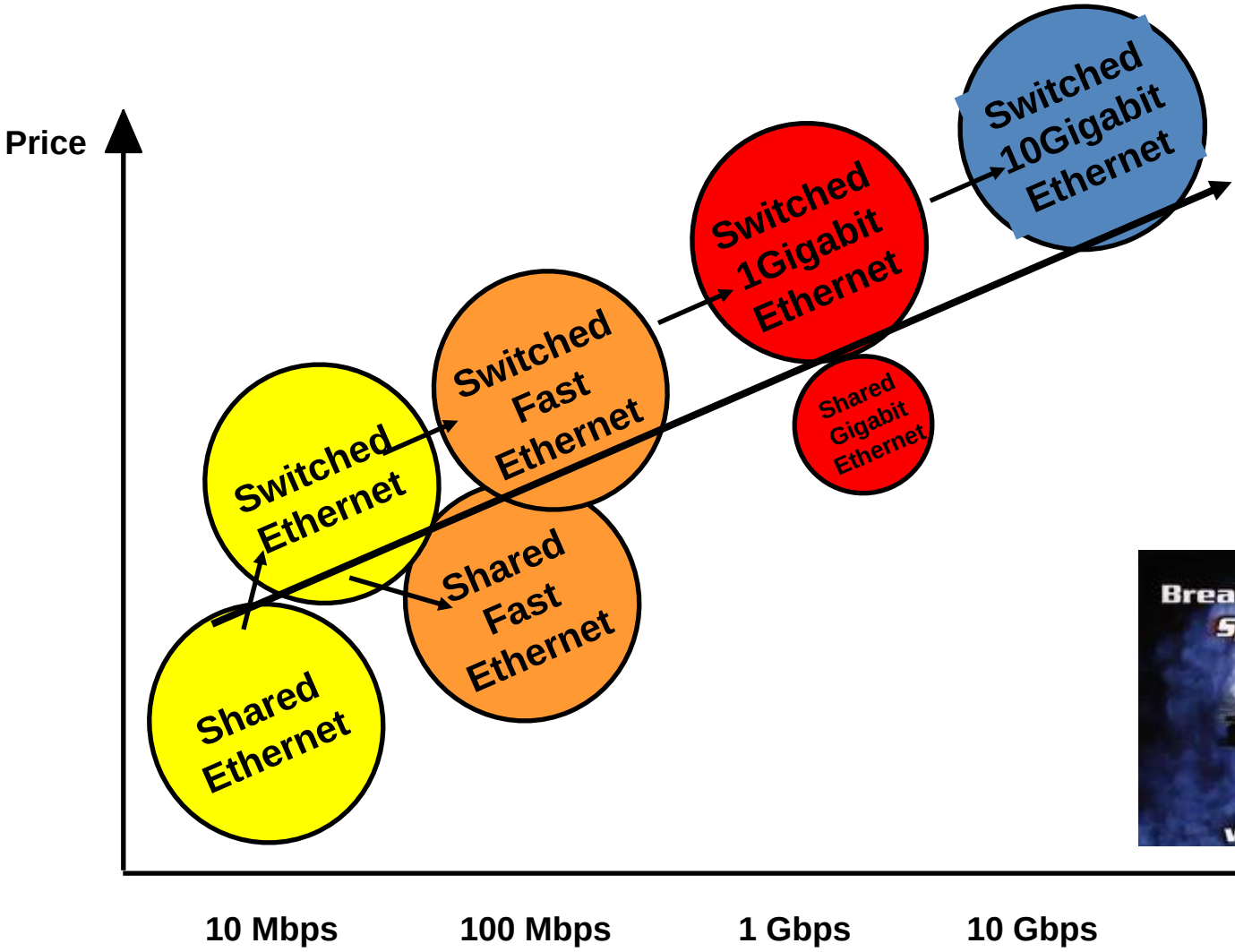
- Reliability and availability
- Profitability and cost-efficiency
- Performance capability
- Future-proof
- Secure
- Industry-standard and rugged
- User friendly and easy to use
- LAN/WAN/SOHO connection
- Real-time capability
- Scalability
- Training concept
- Service concept
- Compliant to standards (IEEE …)
- Mobility
- Manageability

Bandwidth - Scalable Ethernet



Non-blocking architecture

- Office network:

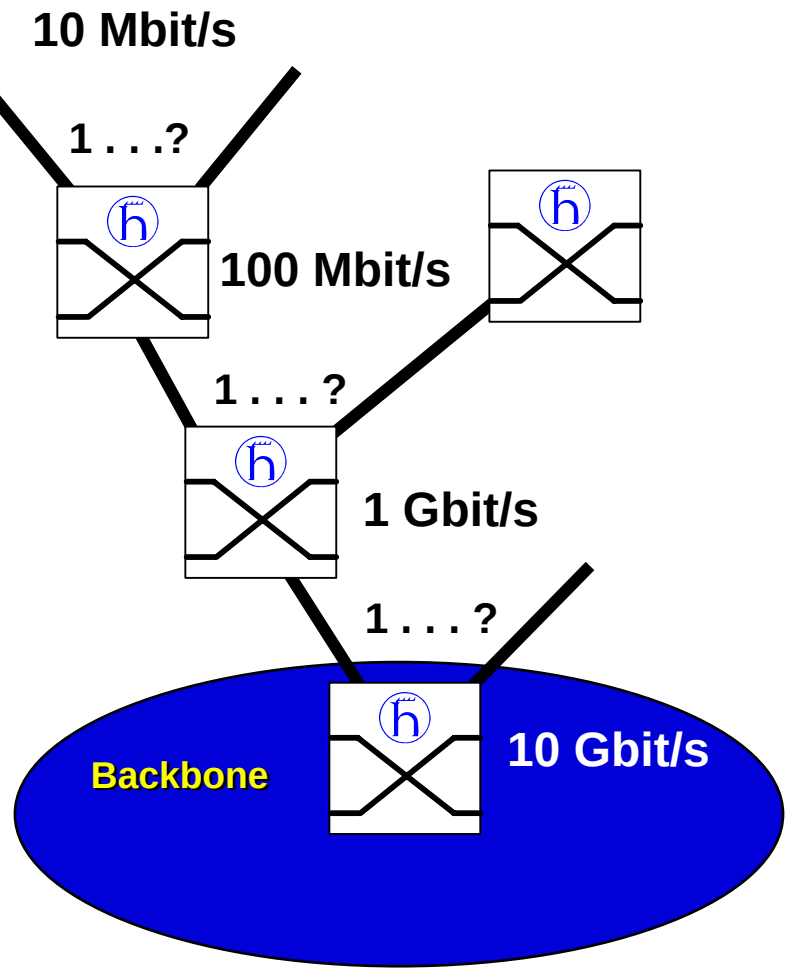
  100 % Non-blocking architecture

  less %

- Industrial network:

  100 % Non-blocking architecture

  or more %



HIPER-Ring topology

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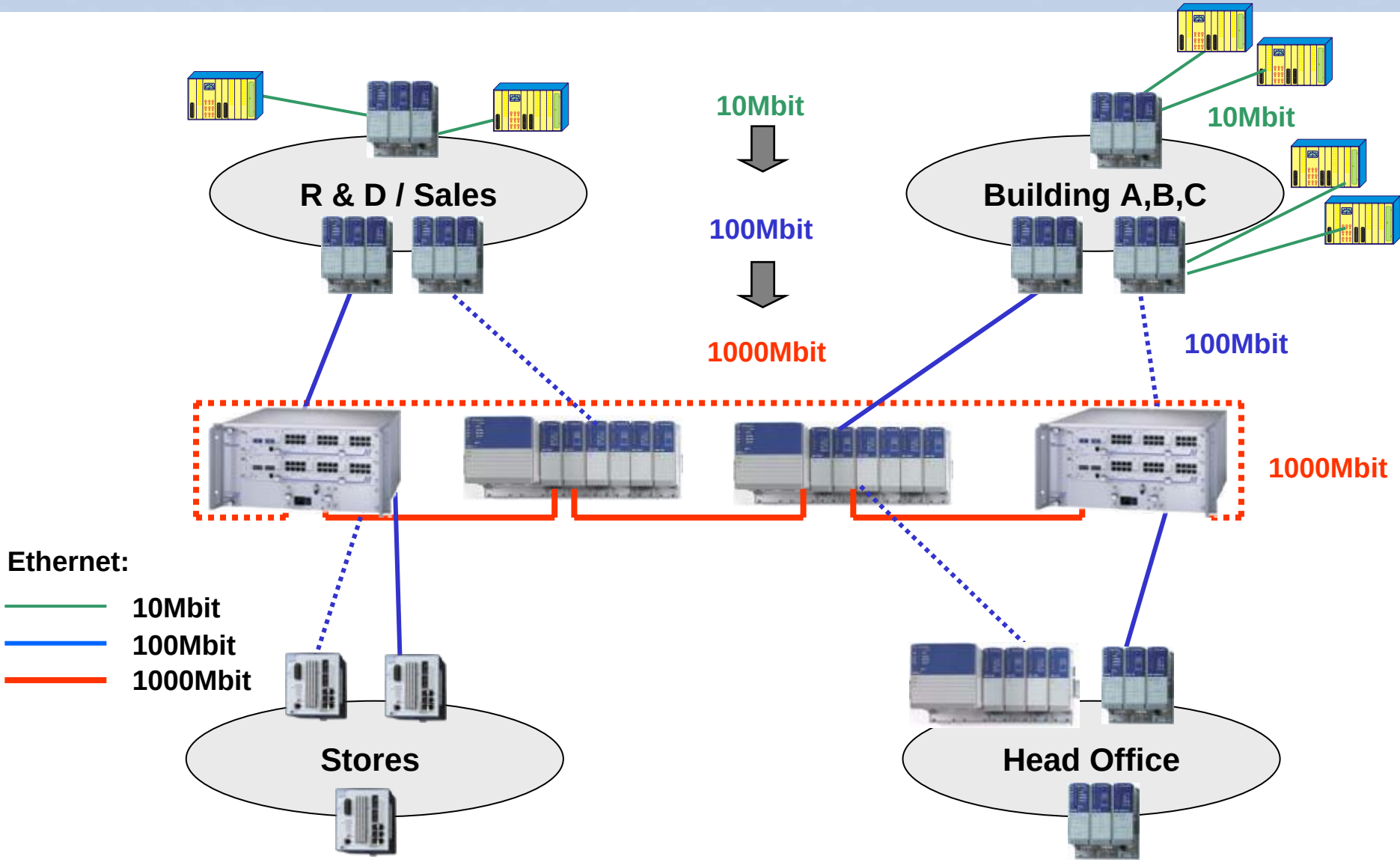

Network of the Ethernet company

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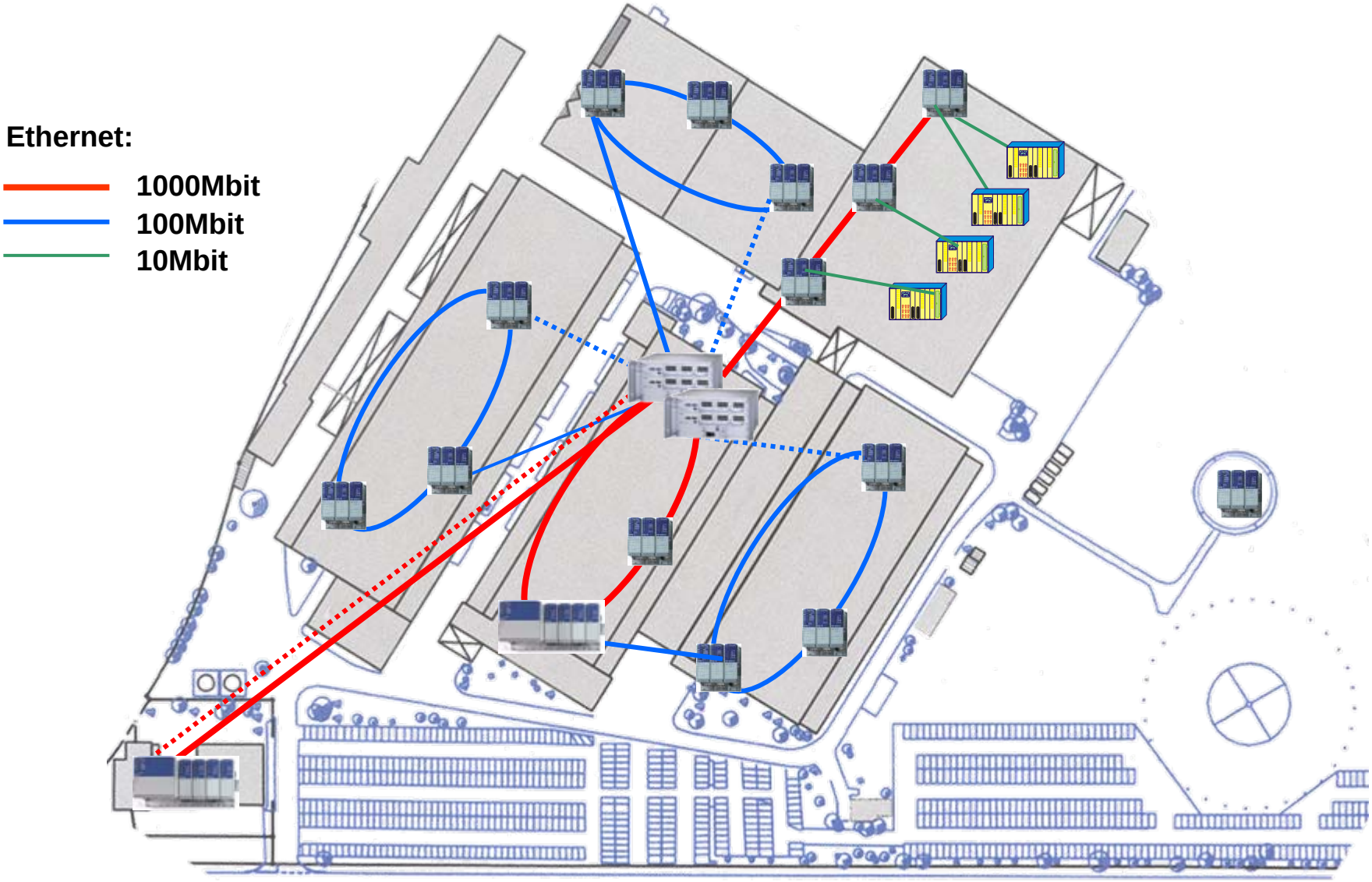

Industrial building switch

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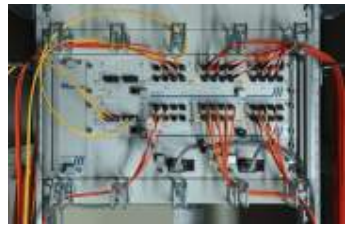
Modular Gigabit Ethernet backbone switch

- High reliability switch
- High availability switch
- Security features
- Convenient network management - local, web-based, SNMP
- Protection of investment
- Modular concept



SNMP = Simple Network Management Protocol

Industrial machine switch

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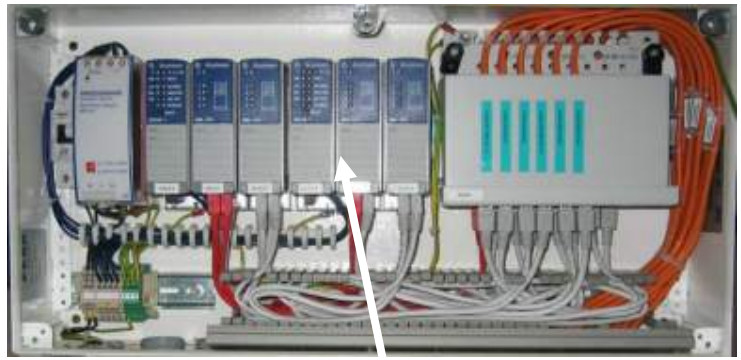
Modular and non-modular Rail Switches



- High reliability switch
- High availability switch
- Fast and easy mounting
- User friendly installation
- Easy to use diagnostics
- Comfortable network management
- Protection of investment

Adding a measurement facility

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- The Ethernet company's network will be expanded to include a measurement facility
- No digging work required
- The connection to the network will be wireless
- Demands of the measurement facility network:
  - Mobile users
  - Flexible
  - High bandwidth
  - Industrial demands
  - High reliability
  - Redundancy

Radome measuring area

Measurement Facility

Wireless

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Wireless network

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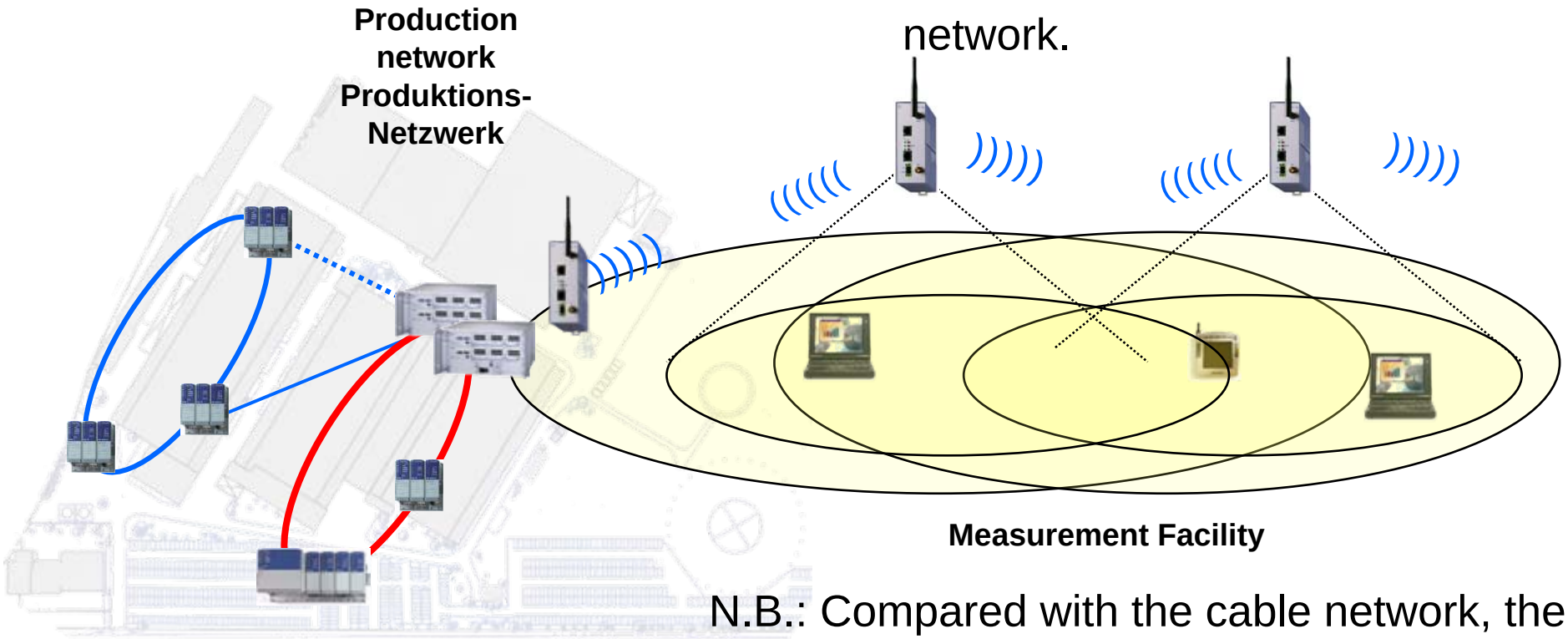
Connect the mobile users via the Access Points to the Ethernet network.



N.B.: Compared with the cable network, the wireless network is a “potentially insecure” network.

-> Pay attention to this at the design stage

Technology overview

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IEEE 802

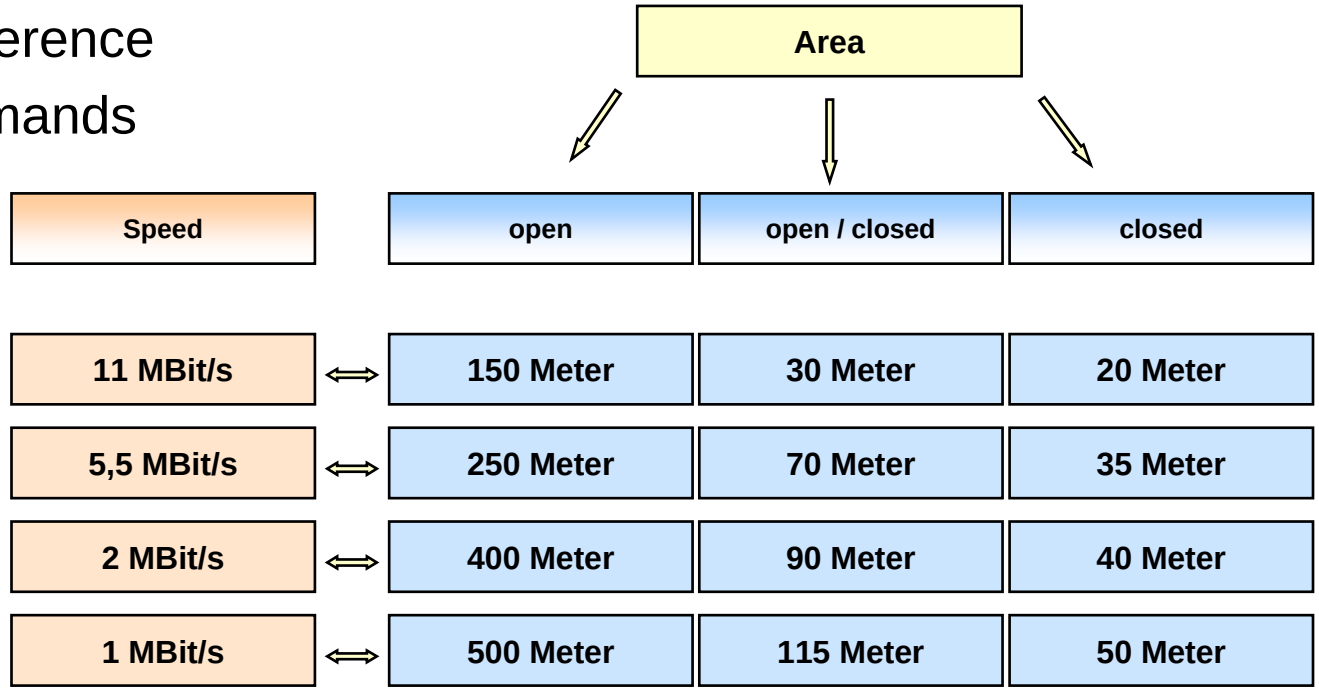
	802.11b	802.11g	802.11a/h
Wave band (MHz)	2400,0 - 2483,5	2400,0 - 2483,5	5150 - 5350, 5470 - 5725
Spectrum	83,5 MHz	83,5 MHz	455 MHz
Non overlapped channels	3	3	8 11
Transmitting power (mW)	100	100	200 - 1000
Data rate gross (Mbit/s)	**11**	**54**	**54**
Data rate net (Mbit/s)	5	22	22
Used for	indoor, outdoor	indoor, outdoor	indoor, outdoor
Range	up to 300 m	up to 300 m	up to 70 m
Modulation process	DSSS	OFDM	OFDM

DSSS (Direct Sequence Spread Spectrum) DSSS (Orthogonal Frequency Division Multiplexing)

Range problem

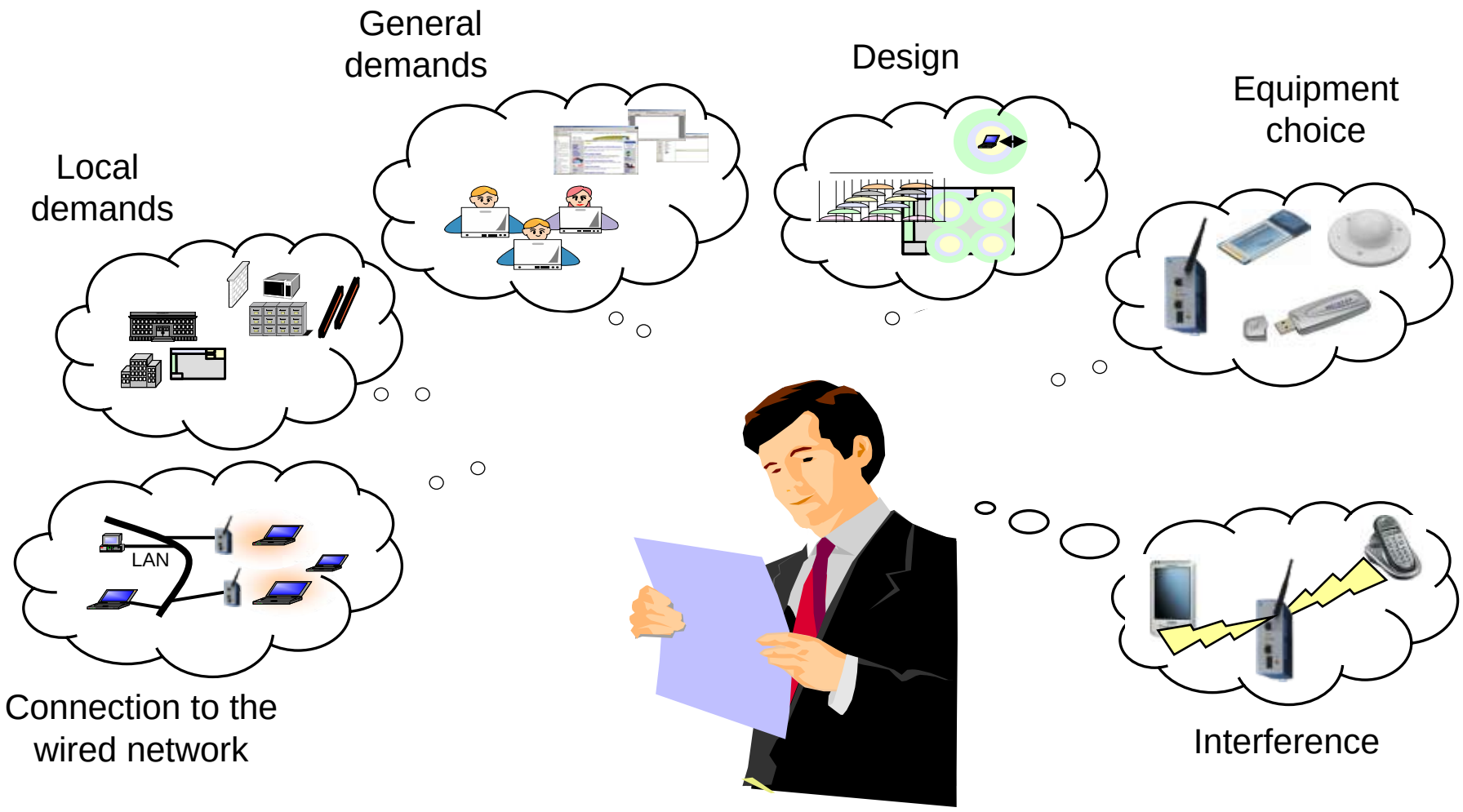
The range depends on:

- Antennas characteristics
- AP transmitting power
- HF cable properties
- Sources of interference
- Construction demands

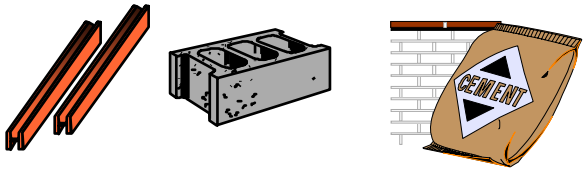


AP = Access Point
HF = High Frequency

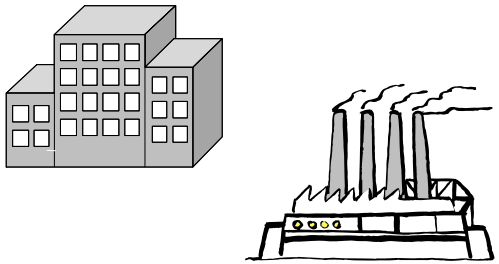
Wireless design



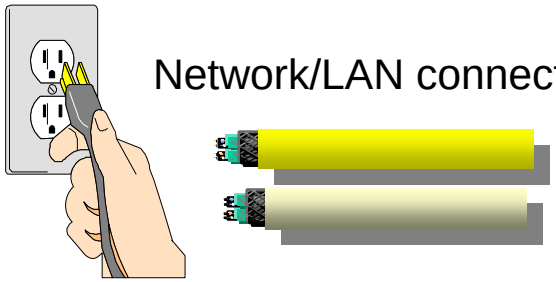
Site survey demands



Material properties



Building information



Network/LAN connection

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Wireless Site Survey Requirements

- Network plans, pictures ...
- Plan of the area
- Required coverage area(s)
- Information on the redundancy demanded by the customer
- Knowledge on how to and where to attach the wireless infrastructure to the LAN
- The number of the clients
- Where is electricity available or can be made available – is Power over LAN an option?
- Required throughput for each client

- Real time demands
- Where can we connect to the cabled LAN
- Which bandwidth is normally used at the cabled backbone
- Detailed Knowledge on the needs of the customer
- Information on the used/planned clients

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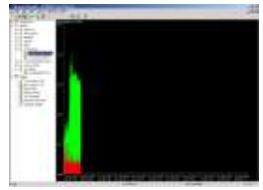
- Information on the used/planned applications
- Information on the area(s) to be covered by radio



- Clarification on security aspects
- Knowledge on available antennas

Wireless products for industrial use

- Access Point, or Access Client for up to 8 devices
- IEEE 802.11 standard
- Plug & Play
- Large input voltage: 9 up to 32 V
- Temperature range: -20 °C to 70 °C
- Full protocol transparency for Layer 3
- Stable connections
- Interference robustness
- Microwave robustness
- Suitable for hostile environments
- Accessories such as antennas, mounting plates, cables

Security

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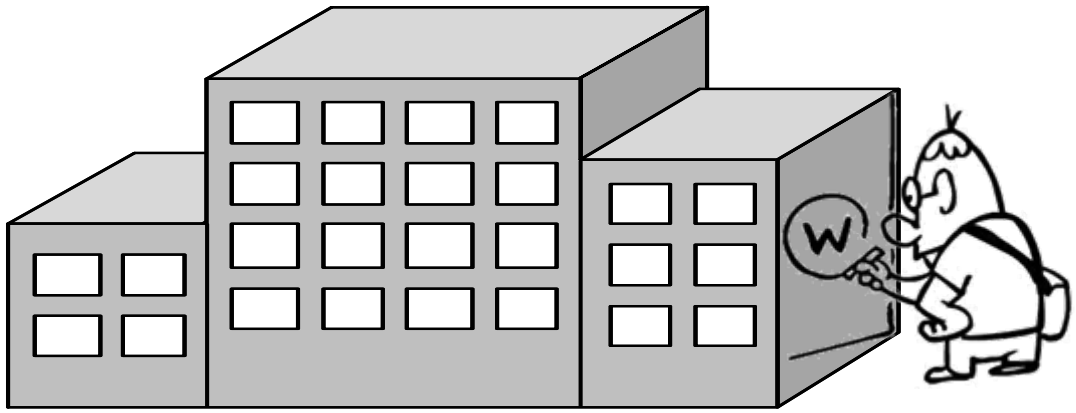
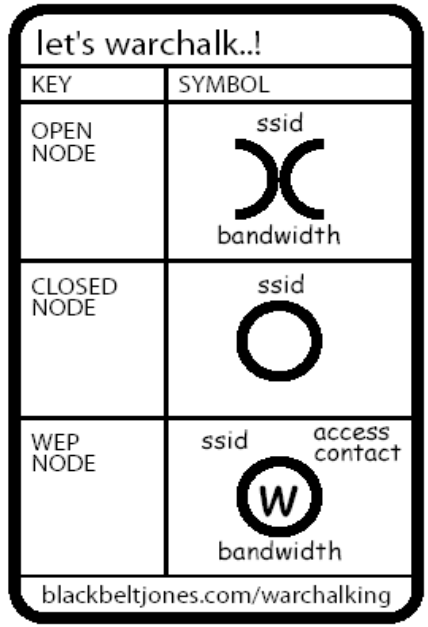
What is Warchalking?

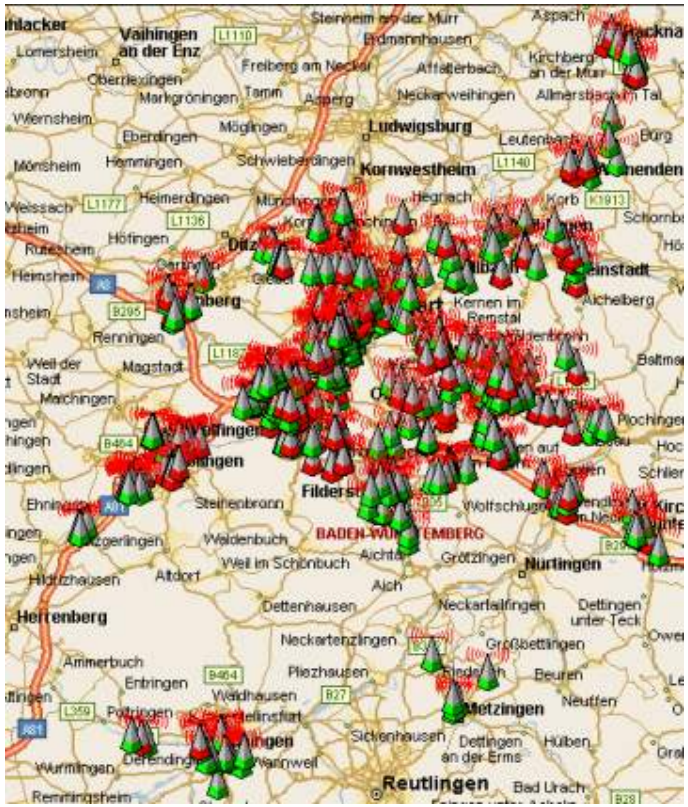
"Warchalking is the practice of marking a series of symbols on sidewalks and walls to indicate nearby wireless access. That way, other computer users can pop open their laptops and connect to the Internet wirelessly."

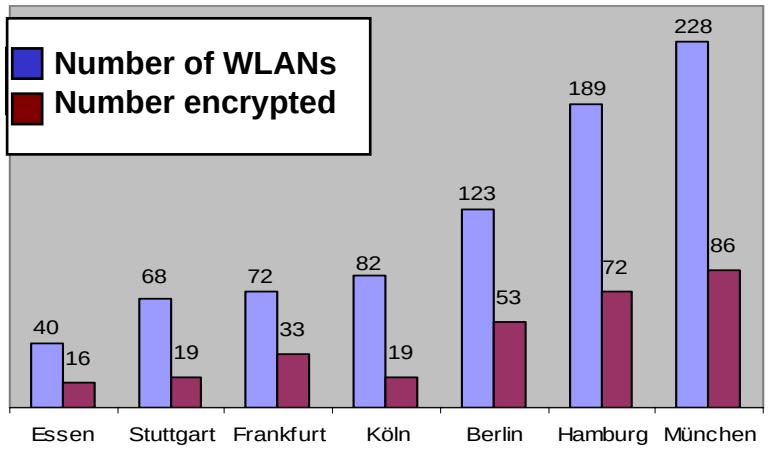




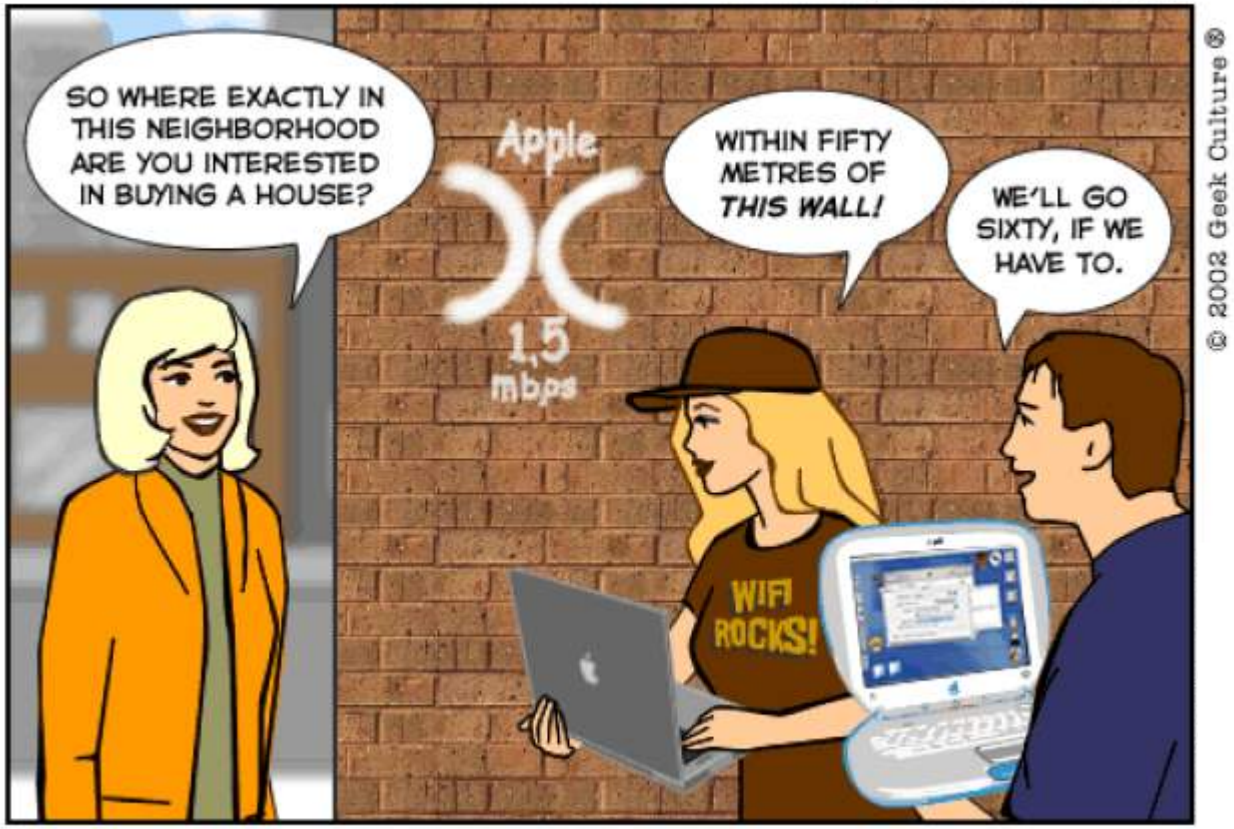
- WarWalking
- WarDriving

A look at the WLAN



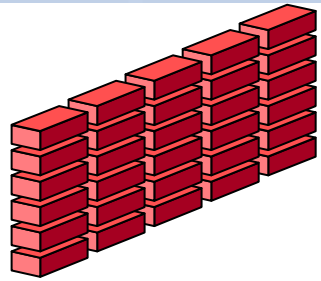


Warchalking



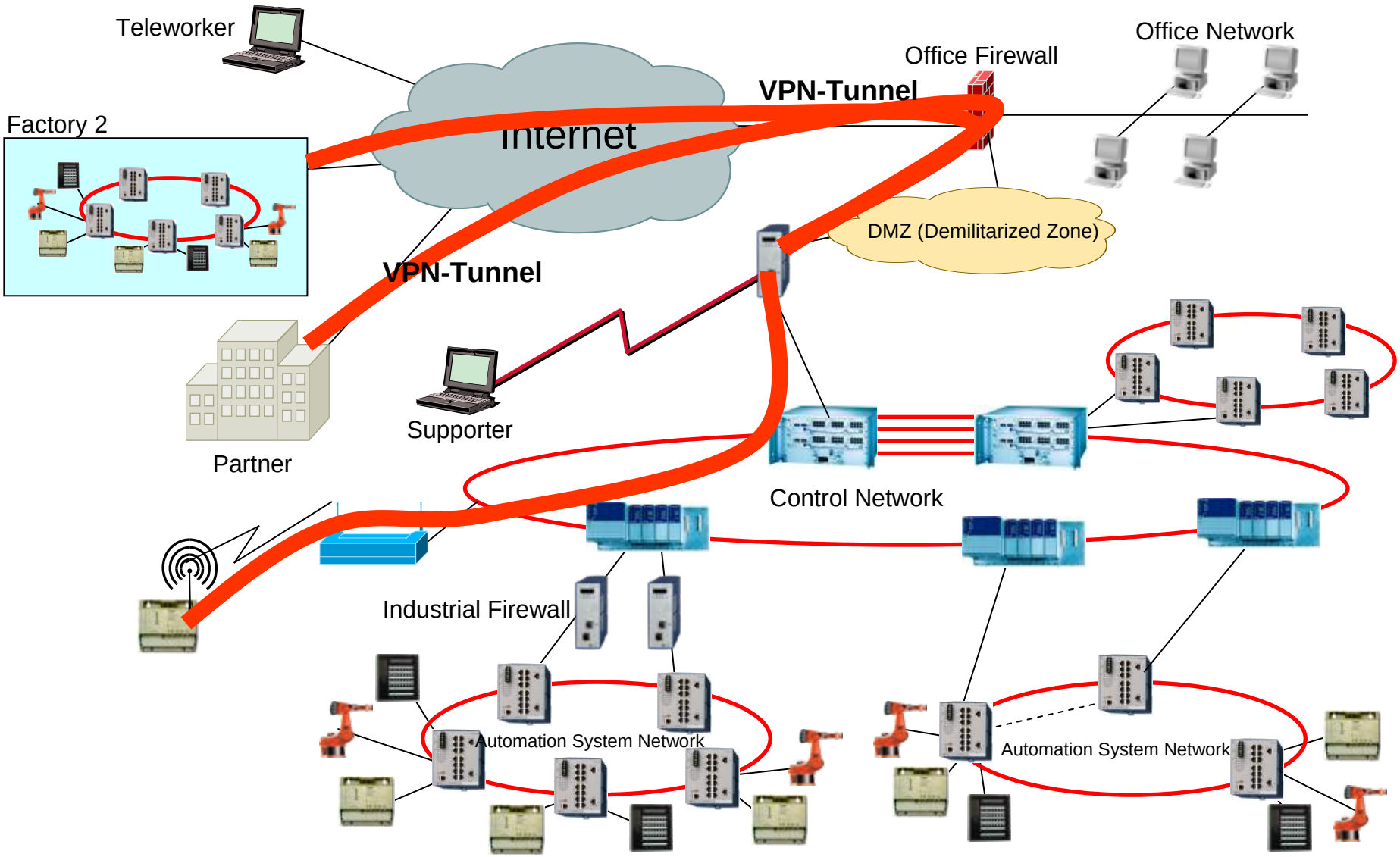
They always dreamed of having a home *in* the range.

What to protect ?



- **Data**
  - Hacker attack (viruses...) and faulty operations
- **System and resources**
- **Image of the company**
  - Protection of the production network
  - More and more industrial espionage
- **System availability**

External connections, B2B, WLAN



Product features overview

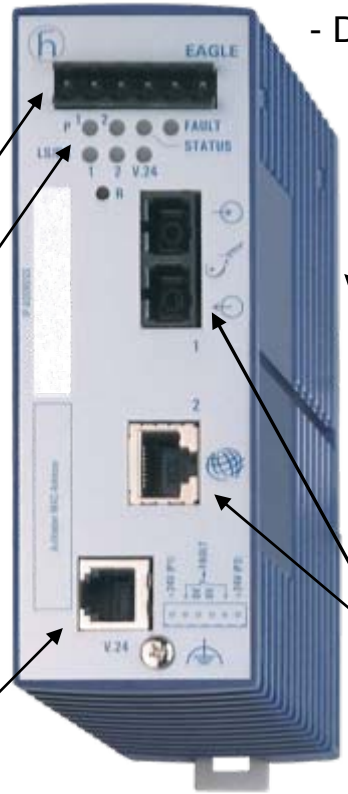
Scalable Security Functionality:
- Pure Firewall
- Firewall with VPN functionality

Simple Integration into existing networks:
- Single Client Transparent Mode
- Multi Client Transparent Mode

Separation of subnets:
- Router mode

Diagnostics:
- Web-based Management
- Signaling contact
- Status LEDs
- Logging on SysLog Server
- Integration in HiVision

Remote access to the network:
- Dial-in access via V.24



Support of Hirschmann Redundancy scenarios:
- Redundant Ring Coupling
- Dual Homing

Easy Start Up
- HiDiscovery Support
- Support of autoconfi-guration adapter

Industrial Graded Design:
- Redundant 24 V power supply
- DIN Rail mountable
- IP20, fanless

Migration into existing networks:
Twisted pair and optical connection for:
- trusted port
- untrusted port

Résumé

- Ethernet is the communication link between processes, applications and system architectures.
- Ethernet is open, standardised, and new protocols and improvements are constantly being developed.
- Different requirements for equipment in industrial environments
- Comprehensive redundancy results in high network availability.
- Wireless solutions open the doors to new applications
- Security is the “hot” topic
- Advantages of choosing a flat or hierarchical structure
- Network management is the precondition of high reliability

Industrial Ethernet -

- Secure your investment