

Data Center Auditing

What you need to know about your DC infrastructure

Volkmar Bend DCDC

TÜV Informationstechnik GmbH

Member of TÜV NORD GROUP



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

AUDIT

An audit is a systematic and independent examination of records, documents and vouchers of an object or an organization to ascertain how far the statements and disclosures present a true and fair view of the object of the audit. The auditor perceives and recognizes the propositions before him / her for examination, obtains evidence, evaluates the same and formulates an opinion on the basis of his judgement which is communicated through his audit report.

Any subject matter may be audited. Audits provide third party assurance to various stakeholders that the subject matter is free from material misstatement. Areas which are commonly audited include: Compliance audit, internal controls, quality management, project management.

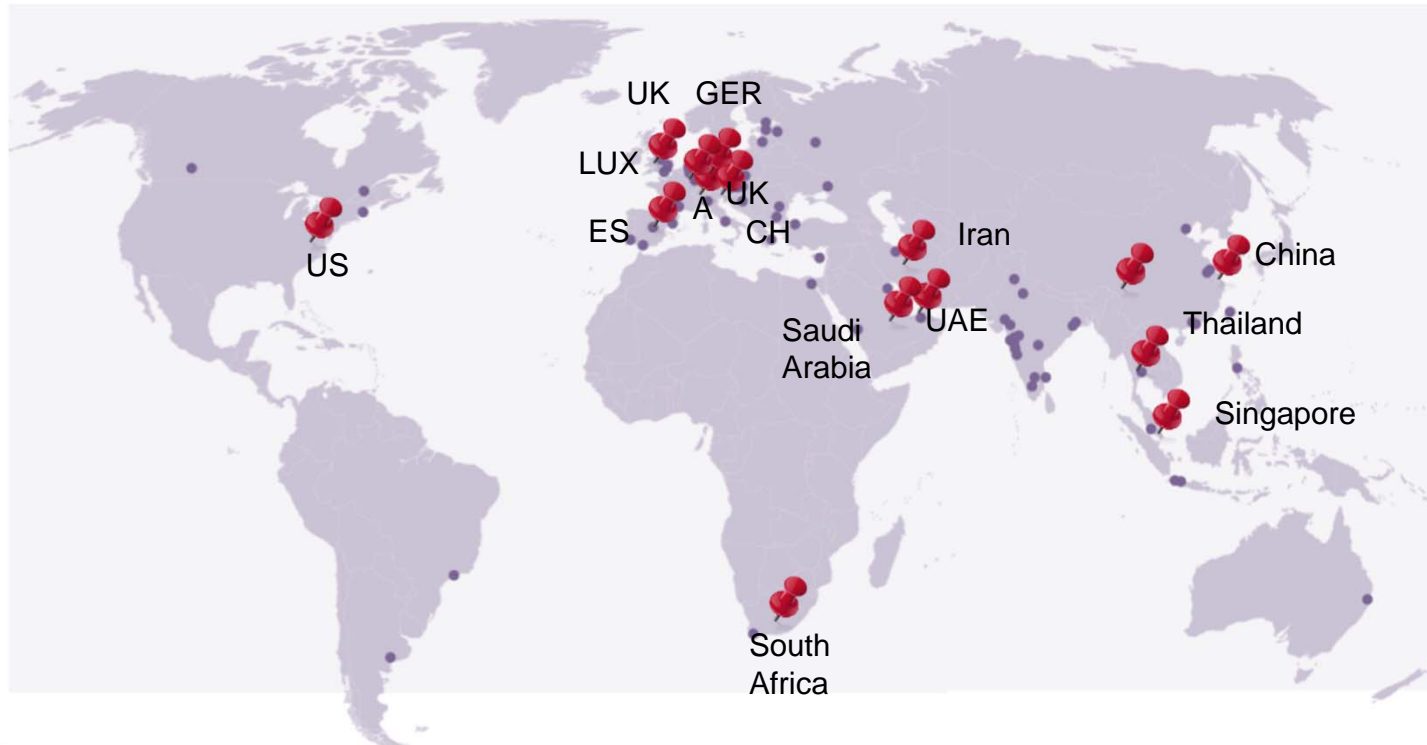
As a result of an audit, stakeholders may effectively evaluate and improve the effectiveness of risk management, control, and the governance process over the subject matter.

Source: Wikipedia



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

TÜVIT TSI INTERNATIONAL – AUDIT AND CERTIFICATION PROJECTS



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CONTENTS

- Reasons for an audit
- Benefits
- Nature and scope
- On-site inspection
- More than a checklist
- Result and conclusion

Reasons:

Insecurity about the current status of a data center, i.e. level of resilience, survivability, code conformance. Or as a basis for a refurbishment or expansion project. Or to be used as an internal or external proof of quality (marketing tool).



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

RISK POTENTIALS

- Force Majeure
- Technical faults
- Criminal acts
- Negligence



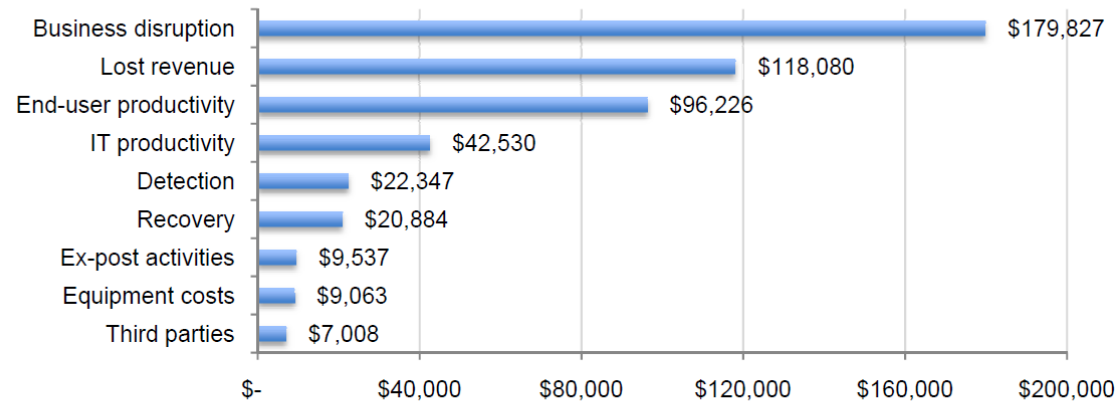
2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

AVAILABILITY

Data center requirements 24/7

Bar Chart 2: Average cost of unplanned data center outages for nine categories

Computed from 41 benchmarked data centers



Sponsored by Emerson Network Power

Ponemon Institute© Research Report



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

PRINCIPLES OF AVAILABILITY

- Fault tolerance
- Redundancy
- Separation
- Robustness
- Scalability
- Prioritization
- Transparency
- Automatism
- Autonomy
- Diversification

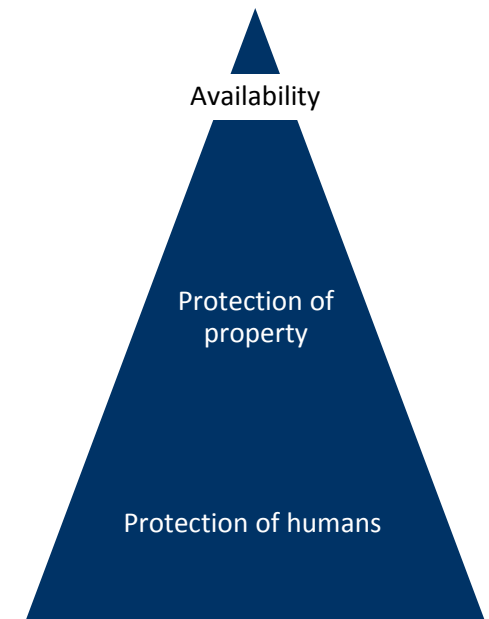
24/7



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

AVAILABILITY

- There are requirements by authorities, statutory organizations, supervisory boards, etc., published in form of guidelines, laws, codes, regulations, ...
- Priority are health and safety issues
- Examples
 - Building codes
 - Fire protection
 - etc.
- There are recommendations regarding the protection of property
- Definition of availability??



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CONTENTS

- Reasons for an audit
- Benefits
- Nature and scope
- On-site inspection
- More than a checklist
- Result and conclusion

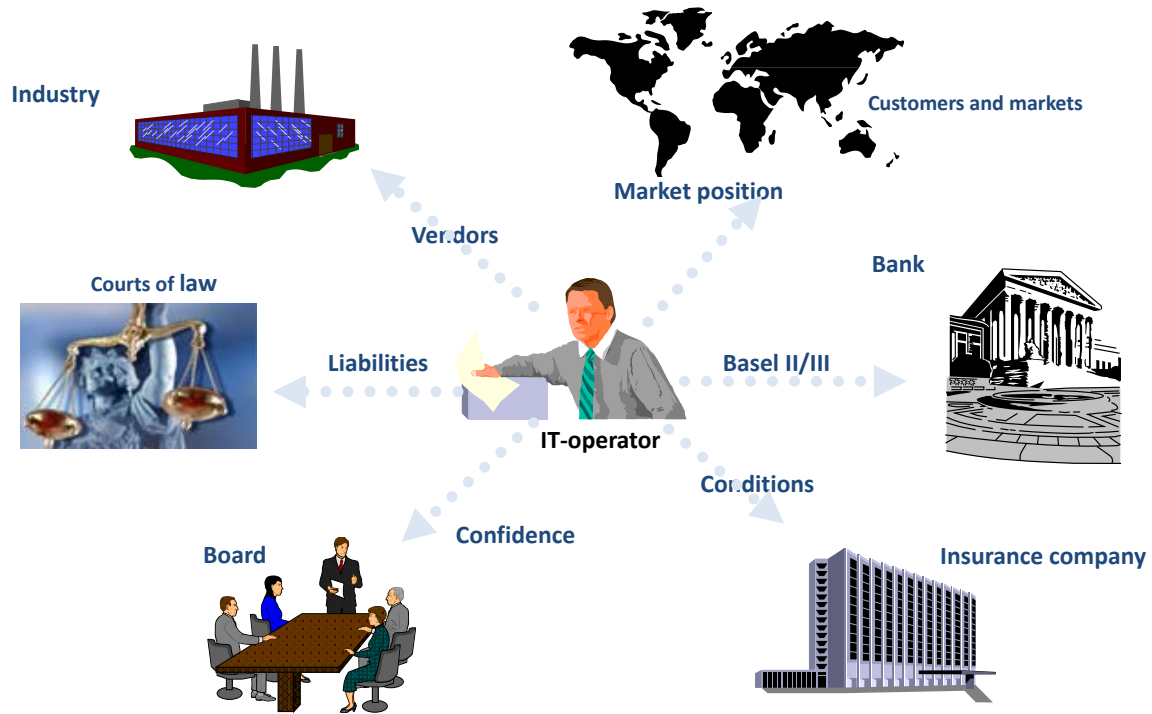
Benefits:

Gaining detailed information about the data center's current status, fault tolerances, uncovering potential weaknesses to avoid any downtime, providing recommendations regarding enhancements and / or potential alternatives.



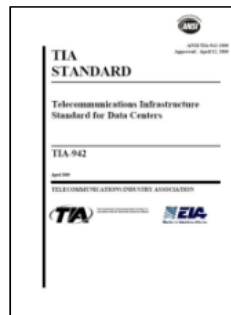
2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

BENEFITS



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

THERE ARE MANY DESIGN GUIDES ...



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

EXCERPTS FROM THE TIA-942

F.5.4 Tier 4 (electrical)

Tier 4 installations should meet all requirements of tier 3.

Tier 4 facilities should be designed in a '2(N+1)' configuration in all modules, systems, and pathways. All feeders and equipment should be capable of manual bypass for maintenance or in the event of failure. Any failure will automatically transfer power to critical load from failed system to alternate system without disruption of power to the critical electronic loads.

Contradiction

ANSI/TIA-942-A

	TIER 1 (E ₁)	TIER 2 (E ₂)	TIER 3 (E ₃)	TIER 4 (E ₄)
<i>Uninterruptible Power Supply System</i>				
Redundancy	N	N	N+1	2N
Topology	Single or Parallel-Modules	Single or Parallel Modules	Distributed Redundant Modules or Block Redundant System	Distributed Redundant Modules or Block Redundant System
Automatic Bypass	Not required	Yes with non dedicated feeder to automatic bypass	Yes, with dedicated feeder to automatic bypass	Yes, with dedicated feeder to automatic bypass



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

AUDIT CATALOGUE

- Conclusion: The basis for an audit should be defined in a way that inspections will be comprehensive and results reproducible.
- Examples from the audit catalogue:

L1 L2 L3 L4

POW01.06 A/B supply for the IT equipment

. . B C

Implementation of two separate supply paths with regard to fire protection. Each supply path is able to supply the IT up to a level of 100%. The load is distributed as symmetrically as possible over both paths, so that during normal operation each path carries approximately 50% of the load.

B: With only one medium-voltage control room, additional measures have been implemented for the secondary supply (e.g. redundancy n+1 or preparation for the connection of a mobile secondary power source).

C: Implementation is carried out as described in the text above.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CONTENTS

- Reasons for an audit
- Benefits
- Nature and scope
- On-site inspection
- More than a checklist
- Result and conclusion

Nature and scope:

An independent third party analysis, neutral and vendor independent, carried out by trained and experienced data center professionals, preferably with an engineering background, involving the client's staff or representatives.

Covering all relevant fields including site and building, electrical and mechanical systems, security systems, cabling, organization and documentation, considering recognized national and international data center standards.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

IMPULSES

Important:
Holistic
approach



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

ENVIRONMENT



Avoidance of

- Flooding areas
- Major traffic arteries
- Explosion hazards
- Airborne contaminants
- Sources of vibration
- Political targets
- Event venues
- Etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CONSTRUCTION



- Protection of incoming supply lines
- Arrangement of rooms
- Constructive fire protection
- Constructive water protection
- Protection against intrusion
- Lightning protection
- Spatial separations
- Etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

FIRE PROTECTION



- Central panel
- Smoke and other detectors
- VESDA systems
- Fire suppression systems
- Fire prevention systems
- Fire dampers
- Etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

SECURITY SYSTEMS



- Access control system
- Gathering of data
- Coding
- Intrusion protection system
- Detectors
- CCTV
- Security zones
- Security personnel
- Etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

ENERGY SUPPLY



- TN-S Net
- Redundancies
- Transformers
- UPS
- Generator
- Fuel storage
- Cable pathways
- SPDs
- Etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

HVAC



- CRAC units
- Chillers
- Cooling towers / heat exchangers
- Piping and valves
- Leakage detection
- Ventilation and air filtering
- BAS
- Etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

ORGANIZATION



- Maintenance + repairs
- Proper operation
- Responsibilities
- Security inspections
- Coordination between IT + FAC
- Testing
- Training
- Etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

DOCUMENTATION



- Security concept
- Environmental analysis (min. 1.5 mile radius)
- DR concepts
- Floor plans
- Schematics
- Installation layouts
- Energy- and AC requirements
- List of alarms
- Etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

2 SITES



- 2 Data centers at
- 2 Locations
- 2 Supply paths and
- Redundant connections
- With different environmental risks



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CABLING



- Redundant WAN links
- Separation of power and data cables
- Installation of cables
- Rack built-up
- Rack feeds



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CONTENTS

- Reasons for an audit
- Benefits
- Nature and scope
- On-site inspection
- More than a checklist
- Result and conclusion

On-site inspection:

An onsite inspection by auditing experts as an essential auditing component after evaluation of submitted documents to verify the present conditions, incl. testing and an assessment of capacities, constraints and operation procedures.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

BASIC REQUIREMENTS

Documents

- current
- Originator
- Hard copy and/or digital
- Documents
 - Legend
 - Scale (with floor plans)
 - Date
 - Suitable scale

Personnel

- Knowledgeable contact persons
- Access to all buildings, systems, and components
- Potentially with prior NDA



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CHECKING OF DOCUMENTS – COMMENTS

- Check on completeness
- Distribution of documents according to disciplines
- Analysis of security concept in combination with enclosed plans and schematics
- Comparison of descriptions to TSI requirements. Non-conformities, undocumented implementations and misleading explanations will be collected in a comments list.
- Check of documents as preparation for on-site inspection



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

DOCUMENTATION



Risk analysis
Security concept
Fire protection concept
DR plan
Environmental analysis



Site plan
Floor plans
Sections
Projections onto floor plan of

- main supply pathways
- security zones
- intrusion detectors
- EAC components
- CCTV cameras
- misc. sensors, e.g. leakage



Schematics

- EAC
- Intrusion detection
- Fire detection
- Fire suppression
- Energy supply
- Mechanical supply
- Ventilation



Name plate information of important components, e.g. transformers, UPS, batteries, gen sets, chillers, cooling towers, etc.
Energy balance
Cooling capacity balance
Acceptance certificates
Room list
Door / Windows schedule



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

TECHNICAL KNOW-HOW

- An interdisciplinary team of technical experts will audit and evaluate the data center, e.g. from the following fields:
 - Electrical engineering
 - Mechanical engineering
 - Electronic security systems
 - Architects
 - Physicists
 - Information technology
 - Cabling specialists



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

ON-SITE INSPECTION

- Audit
 - Environment
 - All IT-rooms
 - All support rooms
 - All adjacent rooms
 - Control room
 - Pathways
 - Roof
 - Raised floor and risers
- Level 2: 2 auditors 1 day
- > Level 2: 3-4 auditors 1-3 days
- Discussion of concepts and implementation with local technical staff or planners
- Triggering of alarms
- Photos of special situations



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CONTENTS

- Reasons for an audit
- Benefits
- Nature and scope
- On-site inspection
- More than a checklist
- Result and conclusion

Not just checklist:

A customized format but based on well documented procedures, taking into account the data center's specific characteristics by analyzing and evaluating all aspects, using an engineering-based and protection-objective approach.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

THE AUDIT AND CERTIFICATION SCHEME

Audit catalogue



Design guides



UPTIME TIER



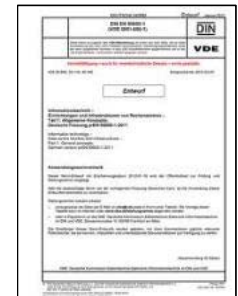
BICSI 002



TIA 942



BITKOM



EN 50600



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

THE PROBLEM WITH AN AUDIT



Some things can be measured precisely, different to the quality of a data center ...



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

THE PILLARS OF INFRASTRUCTURAL MEASURES

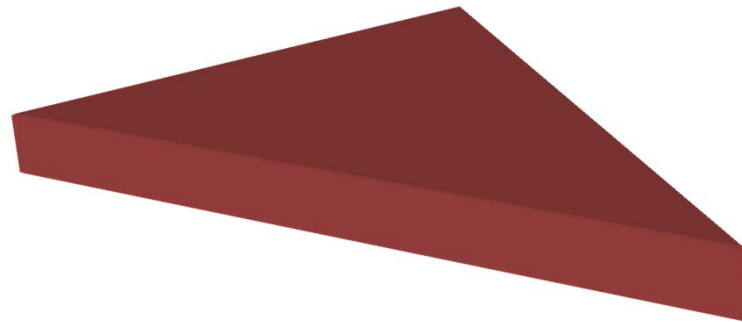
Smoke detectors
Temperature sensors
EAC
etc.

Detection

Precaution

SPSs
Intrusion protection
UPS
etc.

but also
Planning
certification



Reaction

Forwarding of alarms
Fire suppression
Switching between power sources
etc.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

METHODOLOGY: COMPLY OR EXPLAIN

Goal:
Avoidance of major traffic arteries with an increased risk of the transport of hazardous goods (risk analysis)

Distance to major traffic artery

Type of construction

Room arrangement

Protection by other objects

Course of traffic artery

Speed limit

User frequency

Type of road

Accident statistics



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

CONTENTS

- Reasons for an audit
- Benefits
- Nature and scope
- On-site inspection
- More than a checklist
- Result and conclusion

Outcome:

The evaluation reports must be comprehensive, concise and pragmatic, making practical recommendations for improvements and suggestions for a realistic implementation, specific to the audited facility, with reproducible conclusions.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

TYPICAL PROBLEMS (EXAMPLES)

- Fire stops
- Fire loads (boxes, waste cans)
- Security deficiencies / differences in quality
- Monitoring of intrusion attempts and protection against intrusion are different things



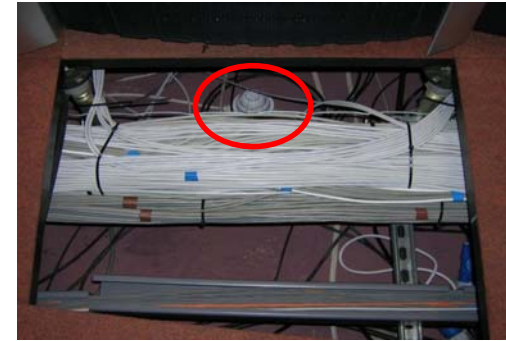
- Congestion of raised floor
- A property „following“ a standard does not conform to the standard



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

TYPICAL PROBLEMS (EXAMPLES)

- Grounding connections
- Human mistakes (design, installation, operation, maintenance)
- Missing sensibility of the personnel
- Reaction to alarms
- Insufficient reserves
- Documentation is not up-to-date



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

PROJECT X

- ABC powder fire extinguishers
- 1 ceiling mounted smoke detector + ASD
- Gas suppression system (3 bottles insufficient)
- EAC tokens in office drawer
- Missing drip trays underneath pipes



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

PROJECT Y

- Position fire dampers
- Caps on ceiling mounted smoke detectors
- Gas suppression system
- Technical building with wooden stairs
- Missing screw in major flange
- Tilted pedestals in raised floor



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

AUDIT AS BASIS OF A CERTIFICATION

The advantages of a certification:

- Creating trust with your clients.
- Provision of a proof of quality for monitoring institutions / internal revision / accountants.
- You are improving and securing the quality of your services.
- Generation of a competitive advantage in the industry.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

VERIFYING IS BETTER THAN A VERBAL STATEMENT



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

A LOOK TO THE FUTURE

What will be the future international standards for Data Centers (and also for audits)?

The ISO/IEC committee has decided on May 18th 2017 to develop documents for sustainable ICT facilities and infrastructure, such as data centers. These documents will use the EN 50600 as the basis and will also consider other standards and best practices.

Resolutions adopted at the 18 May 2017 JTC 1/SC 39 Plenary in Sunnyvale, Ca.



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

AT THE CONCLUSION

Thank you
Merci
Dziękuję
Obrigado
Teşekkür
Dank
Mulțumesc
Köszönöm
Gracias
Gràcies
Tack
Sipas
Danke
Hvala
Dakka
Grazie
dankie
Dankewol
Obrigada
dekem
Paldies
Kiitos
Tak
raibh
Go
fyri
baie
agat
ederim
Gratias
Mahalo
maith
pér



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV

YOUR POINT OF CONTACT



TÜV Informationstechnik GmbH
Langemarckstrasse 20
45141 Essen, Germany

Volkmar Bend DCDC
M.Arch.(USA) Dipl.-Ing.Arch.(TH)
Data Center Auditor
IT Infrastructure
+49-201-8999-579
v.bend@tuvit.de



2017 BICSI *Fall*
CONFERENCE & EXHIBITION
SEPTEMBER 24-28 | LAS VEGAS, NV