Breaking the Rules!

Jeffrey Lam RCDD
What are standards?
- Document that provides requirements, specifications or guidelines that can be used to consistently ensure that materials, products, or processes are fit for purposes

Each country/region has their own standards
- generally aligned with ISO/IEC standards
- adaptations/modifications to meet local conditions

Standard setting bodies
## Standards

<table>
<thead>
<tr>
<th>Application</th>
<th>Office</th>
<th>Industry</th>
<th>Home</th>
<th>Data Center</th>
<th>Buildings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>IEC 61918</td>
<td>ISO/IEC 14763 (part 1,2,3)</td>
</tr>
<tr>
<td></td>
<td>EN 50173-2</td>
<td>EN 50173-3</td>
<td>EN 50173-4</td>
<td>EN 50173-5</td>
<td>EN50173-6</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN 50174(part 1,2)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN 50310</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>EN 50600-2-4</td>
<td></td>
</tr>
<tr>
<td>[Chinese Flag]</td>
<td>综合布线系统</td>
<td>工业企业通信设计规范</td>
<td>电子计算机机房设计规范</td>
<td>智能建筑设计标准</td>
<td></td>
</tr>
<tr>
<td></td>
<td>GB 50311-2007</td>
<td>GBJ 42-81</td>
<td>GB 50174-93</td>
<td>GB/T 50314-2006</td>
<td></td>
</tr>
</tbody>
</table>
Challenges

- Something allowed by one standard may not be allowed by another standard.
- Anything that is not mentioned by a certain standard is often regarded as “not allowed”.
- Something that may be technically allowed may be disallowed due to semantics.

In the end, we create our own rules based on
- the most stringent requirements
- the most understood requirements
- Industry accepted practices
Some RULES we will try to break today

You are not allowed to

#1. splice UTP cables together

#2. connect a RJ45 plug directly to the horizontal cable.

#3. use non-RJ45 connectors for Ethernet.
RULE #1
You are not allowed to splice UTP cables together
The standards...

**ANSI/TIA-568c**  
**Commercial Building Telecommunications Cabling Standard**  
-specified for commercial buildings  
-cabling components & transmission requirements

**Topology**  
The horizontal distribution system must follow a star topology.  
- The telecommunications outlet/connector in the work area is to be directly connected to a horizontal cross-connect in a telecommunications room located on the same floor as the work area.  
- **Bridged taps and splices are not permitted.**
ISO / IEC 11801
Information technology -- Generic cabling for customer premises
- specifies cabling components and transmission requirements for a
cabling system.

....No mention of splicing…
Horizontal Cabling

Splicing of a horizontal cable
Horizontal Cabling

Splicing of a horizontal cable

patchpanel 1

Consolidation point

information outlet
ANSI/TIA 568c
Commercial Building Telecommunications Cabling Standard

Consolidation point
- interconnection point within the horizontal cabling
- Cross-connections shall not be used at consolidation point.
- only one consolidation point shall be used within the same horizontal cable run.
- Serve maximum 12 work areas
- each horizontal cable shall be terminated with a TO/MUTO.
- shall be located in accessible permanent locations
- shall be administered as described in ANSI/TIA 606b
Consolidation Point

What if there is only one port?
Can you still have a consolidation point?
Emergency Ethernet Repair Kit

**Disadvantages**
Cannot be used in designs where a consolidation point/transition point is already present.
Must be properly labelled and located for proper administration.
Call it anything but don’t call it a splice.
Slippery Slope

**Advantages**
Time and costs, esp in repair
Ease of transition for plenum/ outdoor cables.
Testing

Permanent Link
(2 connectors)

Permanent link with a CP
(3 connectors)
RULE #2
You are not allowed to Terminate a RJ45 plug directly to the horizontal cable.
Terminating a RJ45 directly to a horizontal cable

**TIA 568c Commercial Building Telecommunications Cabling Standard**

**ANSI/TIA-862-A: Building Automation Systems Cabling**

**BICSI-005 Guide for the Design and Implementation of ESS Structured Cabling**
ANSI/TIA 568c

Commercial Building Telecommunications Cabling Standard

Horizontal cabling

• up to 100 meters of twisted pair
• In the TR, the cable is connected to the patch panel
• At the WA, the cable is terminated with a telecommunication outlet (TO)
• Connect the TO to the device

• A TO is described as a RJ45 jack / 8p8c connector
patchpanel 1

patchpanel 2

information outlet

1

2

3

4
ANSI/TIA-862-A: Building Automation Systems Cabling

**Topology**
- Horizontal cabling shall be a star topology
- BAS architecture is permitted but may have distance limitations
- Horizontal connection point (HCP)
  - One HCP per horizontal cabling link
  - cabling from HCP shall be terminated to a BAS device or outlet
  - Commonly used for plant rooms
BICSI-005
Electronic Safety and Security (ESS) System Design and Implementation Best Practices

• recognizes the direct attach as a viable connectivity for ESS devices.

A Single Connector Modified Permanent Link
• direct attach plug-ended
• One end of 90-meter cable connected to patch panel
• The other end terminated with an RJ-45 plug
• A Consolidation Point (CP) may be also be included
Pros & Cons of Direct attached

Disadvantages
Flexibilty = fixed length
Unsuitable for frequent replugging
More difficult to administer

Advantages
Costs
Higher reliability / security
Code : Plenum considerations
Warranty issues

- Several manufacturers started looking at warranty

- Not all plugs are created equal.
  - Cables have different core size
  - Design for solid core & stranded cables are different
  - Specialized tools may be required
  - Quality of field termination critical - esp Cat 6A
  - IP Rating
Testing and Warranty

Single Connector Modified Permanent Link (1 connector)

- Permanent Link Adapter on the near end
- Channel adapter at the far end.
RULE #3
You are not allowed to use non RJ45 connectors for Ethernet
ANSI/TIA 568c
Commercial Building Telecommunications Cabling Standard

- Describes the 8P8C modular connector for Telecom Outlets
- Describes the T568A and T568b pin assignments
- No other connectors / pin assignments mentioned

- RJ45 is a common designation used for the modular 8 wire connector
- RJ45 is the default for the dry / office environments
- We have been using non-RJ45 connections in the Telecom Room
- IEC60603-7 describes multi-pin modular connectors for telephone and data systems
Markets are merging, Ethernet communication connects market sectors to one structured communication solution.
IEC 24702
Information Technology - Generic Cabling – Industrial premises
- defines the MICE classifications for different environments

![MICE Diagram](image)

<table>
<thead>
<tr>
<th>Group</th>
<th>Office</th>
<th>Light Industrial</th>
<th>Heavy Industrial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mechanical</td>
<td>$M_1$</td>
<td>$M_2$</td>
<td>$M_3$</td>
</tr>
<tr>
<td>Ingress</td>
<td>$I_1$</td>
<td>$I_2$</td>
<td>$I_3$</td>
</tr>
<tr>
<td>Climatic</td>
<td>$C_1$</td>
<td>$C_2$</td>
<td>$C_3$</td>
</tr>
<tr>
<td>EMC</td>
<td>$E_1$</td>
<td>$E_2$</td>
<td>$E_3$</td>
</tr>
</tbody>
</table>
IEC 24702
Information Technology - Generic Cabling – Industrial premises

- describes different housing to provide IP XX protection to RJ45
- terminate a plug / jack, then insert into housing
The standards...

IEC 61076-2-101
Connectors for electronic equipment
M12 connector
  – Published in 2003
  – designed for sensors/actuators
- to ensure proper connection to industrial components
- resistance against foreign particles, water & hazardous substances
**The standards...**

**IEC 61076-2-101**

**Connectors for electronic equipment**
Different coding to avoid misconnection

<table>
<thead>
<tr>
<th>Type of Coding</th>
<th>Applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>A-coding</td>
<td>General sensor connection (for Europe)</td>
</tr>
<tr>
<td>B-coding</td>
<td>sensor connections for Profibus protocols</td>
</tr>
<tr>
<td>C-coding</td>
<td>General sensor connection (for USA)</td>
</tr>
<tr>
<td>D-coding</td>
<td>Industrial Ethernet (100Base-TX)</td>
</tr>
<tr>
<td>P-coding</td>
<td>Others</td>
</tr>
</tbody>
</table>

A-coded

B-coded

D-coded

X-coded
The standards…

M12 connector for Ethernet

- Evolved with the use of Ethernet in Industrial Automation
  - IEC 24702, Information technology – Generic cabling – Industrial premises
  - IEC 61918, Digital data communications for measurement and control – Installation of communication networks in industrial control systems

- Accepted by ODVA for Industrial Ethernet

<table>
<thead>
<tr>
<th>Coding</th>
<th>Applications</th>
<th>Product Standards</th>
<th>Pins/ wires</th>
</tr>
</thead>
<tbody>
<tr>
<td>M12 D-coding</td>
<td>100Base-TX</td>
<td>IEC 61076-2-101</td>
<td>4 pins</td>
</tr>
<tr>
<td>M12 X-coding</td>
<td>Up to 10GBase-T</td>
<td>IEC 61076-2-109</td>
<td>8 pins</td>
</tr>
</tbody>
</table>
Note

• M12 X-coded connector
  – there is no standard pin assignment for the M12-X.
  – Follow manufacturer’s instructions

• M12 D-coded connector - PoE type
  • 802.3af or 802.3at (type1) for 10BaseT/ 100BaseT
  • Mode A (endspan) supplies on data pairs wires
  • Mode B (midspan) supplies on spare pairs wires
Thank You !!!