LEARN HOW TO CONTROL EVERY ROOM AT A LUXURY HOTEL REMOTELY: THE DANGERS OF INSECURE HOME AUTOMATION DEPLOYMENT

BY JESUS MOLINA
@VERIFYTHENTRUST

If I were to tell someone is able to control every appliance in your hotel room, will you move to another hotel tonight?

#WHOAMI

- Security consultant based in SF
- Full name and title
  - Doctor Jesús María Molina Terriza
- Spanish from la Mancha
- www.jesusmolina.com
- @verifythentrust
- Get me a good tequila at the bar

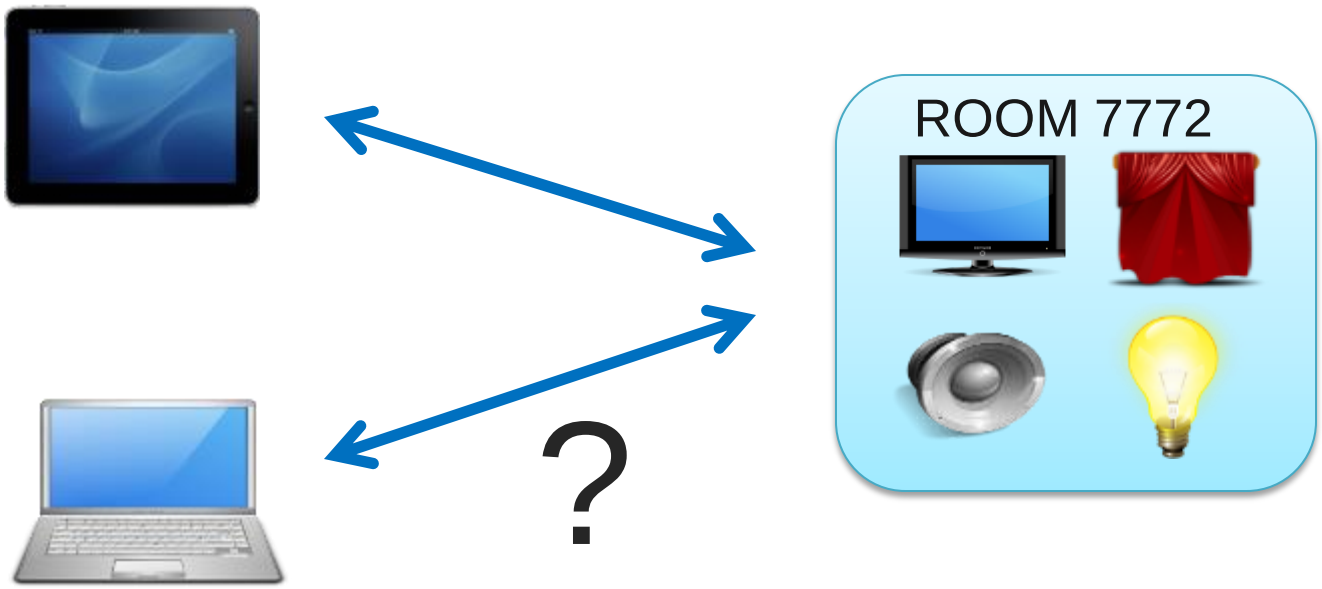
Preliminaries

- Controlled 200+ rooms of a 5 star hotel by abusing an insecure home automation protocol
- While I was a guest of the hotel
- In CHINA
- I did not hack – I abused
- Starwood response was positive

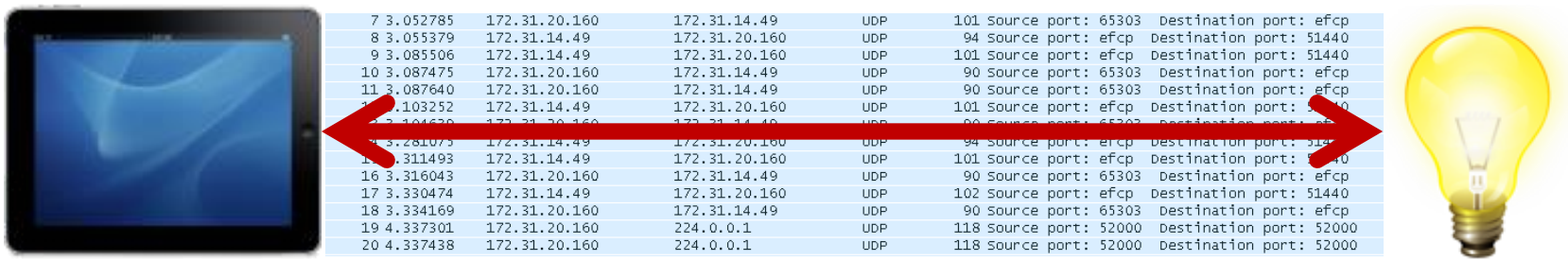
The ST. REGIS SHENZHEN

HOTEL
IS HERE


Room Control
ST.REGIS 8407#
CENTRAL CONTROL
SERVICE
LIGHT
TEMPERATURE
TV
IPTV
HOT PROGRAMS
DVD
HELP
DRAPES CURTAIN
DAY CURTAIN
NIGHT CURTAIN
BATHROOM CURTAIN
BATHROOM MUSIC
MUTE
VOLUME



Could I control the room with my laptop?



7	3.052785	172.31.20.160	172.31.14.49	UDP	101 Source port: 65303 Destination port: efcp
8	3.055379	172.31.14.49	172.31.20.160	UDP	94 Source port: efcp Destination port: 51440
9	3.085506	172.31.14.49	172.31.20.160	UDP	101 Source port: efcp Destination port: 51440
10	3.087475	172.31.20.160	172.31.14.49	UDP	90 Source port: 65303 Destination port: efcp
11	3.087640	172.31.20.160	172.31.14.49	UDP	90 Source port: 65303 Destination port: efcp
[illegible]	.103252	172.31.14.49	172.31.20.160	UDP	101 Source port: efcp Destination port: [illegible]
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	3.281075	172.31.14.49	172.31.20.160	UDP	94 Source port: efcp Destination port: [illegible]
[illegible]	.311493	172.31.14.49	172.31.20.160	UDP	101 Source port: efcp Destination port: [illegible]0
16	3.316043	172.31.20.160	172.31.14.49	UDP	90 Source port: 65303 Destination port: efcp
17	3.330474	172.31.14.49	172.31.20.160	UDP	102 Source port: efcp Destination port: 51440
18	3.334169	172.31.20.160	172.31.14.49	UDP	90 Source port: 65303 Destination port: efcp
19	4.337301	172.31.20.160	224.0.0.1	UDP	118 Source port: 52000 Destination port: 52000
20	4.337438	172.31.20.160	224.0.0.1	UDP	118 Source port: 52000 Destination port: 52000

1 - IPAD IS OPEN TO INSPECTION AND TAMPERING

2 - IPAD IS CONNECTED TO GUEST NETWORK

3 - THE GUEST NETWORK IS OPEN TO INSPECTION AND TAMPERING

4 - THE AUTOMATION PROTOCOL NEEDS TO BE SECURE

5 - But it is NOT

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11	3.087640	172.31.20.160	172.31.14.49	UDP	90	Source port: 65303	Destination port: efcp
12	3.103252	172.31.14.49	172.31.20.160	UDP	101	Source port: efcp	Destination port: 51440
13	3.104639	172.31.20.160	172.31.14.49	UDP	90	Source port: 65303	Destination port: efcp
14	3.281075	172.31.14.49	172.31.20.160	UDP	94	Source port: efcp	Destination port: 51440
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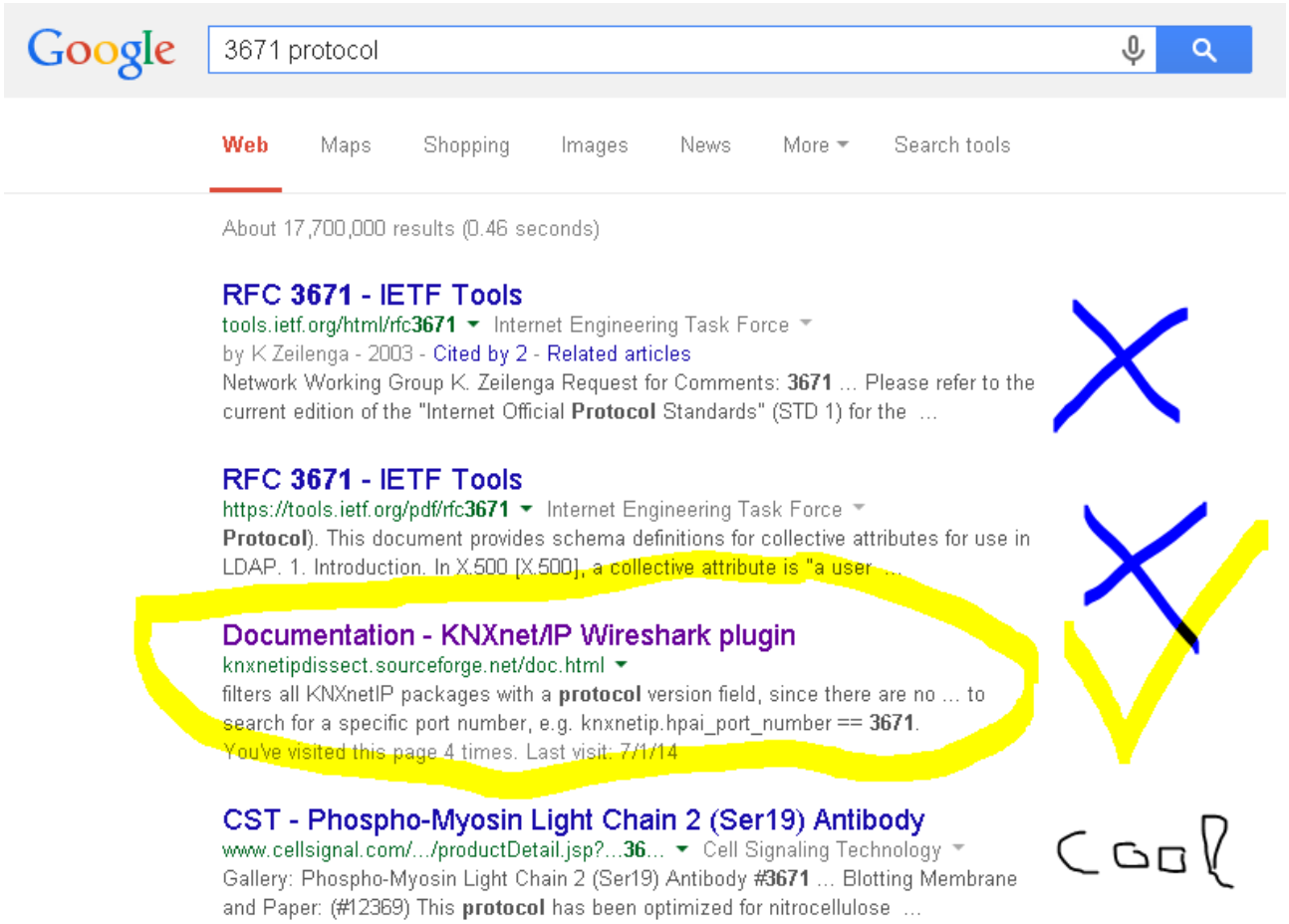
UDP TO A SINGLE IP AND PORT

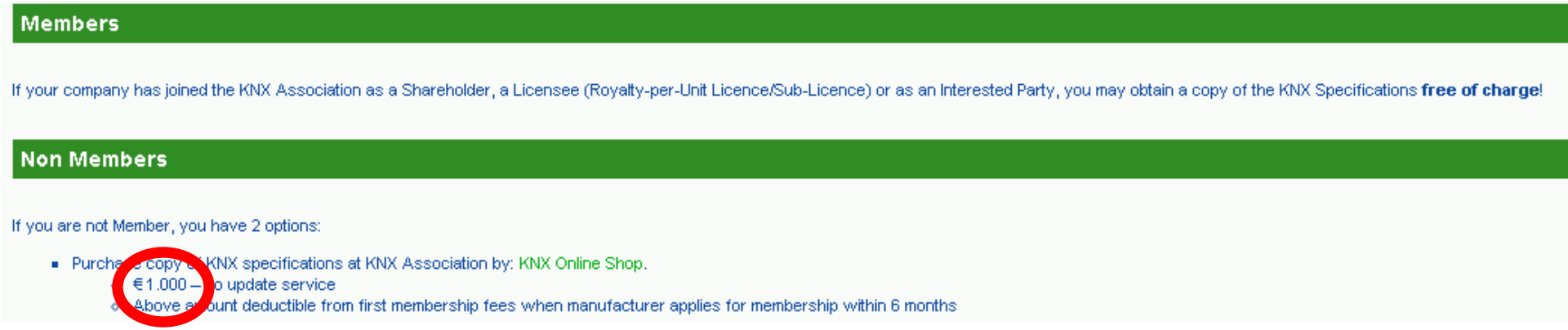

Google
3671 protocol
Web
Maps
Shopping
Images
News
More
Search tools
About 17,700,000 results (0.46 seconds)
RFC 3671 - IETF Tools
tools.ietf.org/html/rfc3671 Internet Engineering Task Force
by K Zeilenga - 2003 - Cited by 2 - Related articles
Network Working Group K. Zeilenga Request for Comments: 3671 ... Please refer to the current edition of the "Internet Official Protocol Standards" (STD 1) for the ...
RFC 3671 - IETF Tools
https://tools.ietf.org/pdf/rfc3671 Internet Engineering Task Force
Protocol). This document provides schema definitions for collective attributes for use in LDAP. 1. Introduction. In X.500 [X.500], a collective attribute is "a user ...
Documentation - KNXnet/IP Wireshark plugin
knxnetipdissect.sourceforge.net/doc.html
filters all KNXnetIP packages with a protocol version field, since there are no ... to search for a specific port number, e.g. knxnetip.hpai_port_number == 3671.
You've visited this page 4 times. Last visit: 7/1/14
CST - Phospho-Myosin Light Chain 2 (Ser19) Antibody
www.cellsignal.com/.../productDetail.jsp?...36... Cell Signaling Technology
Gallery: Phospho-Myosin Light Chain 2 (Ser19) Antibody #3671 ... Blotting Membrane and Paper: (#12369) This protocol has been optimized for nitrocellulose ...
Cool

TRUE FACTS ABOUT KNX/IP

- IP encapsulation of KNX
- KNX is a building automation protocol
- Created in 1990
- Widespread in Europe and China
- Simple to deploy

TRUE FACTS ABOUT KNX/IP

- "Open" meaning "Closed" - 1000€ just to look at it? What is this? 1990s?



Members

If your company has joined the KNX Association as a Shareholder, a Licensee (Royalty-per-Unit Licence/Sub-Licence) or as an Interested Party, you may obtain a copy of the KNX Specifications **free of charge**!

Non Members

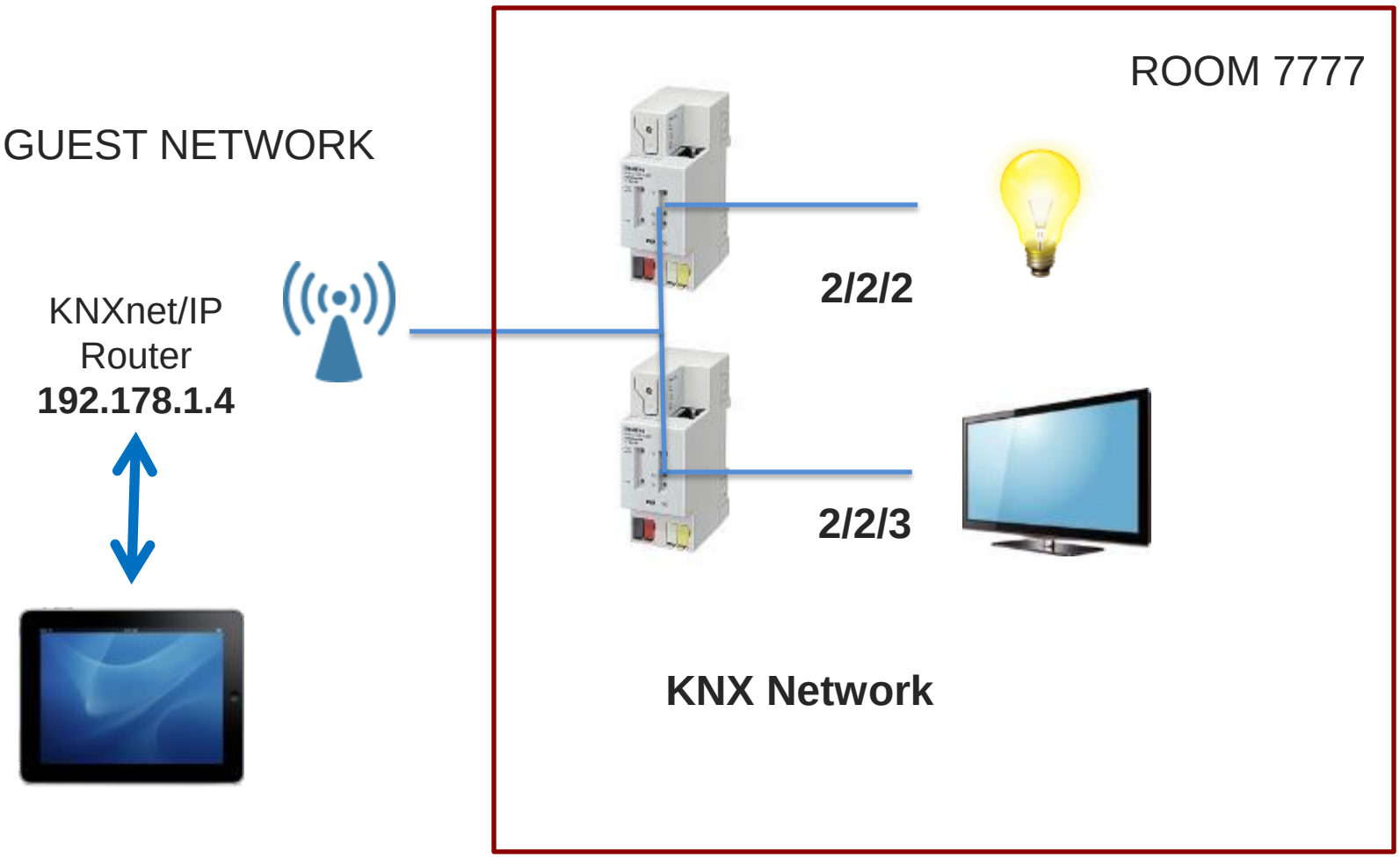
If you are not Member, you have 2 options:

- Purcha[illegible] copy [illegible] KNX specifications at KNX Association by: KNX Online Shop.
  - €1.000 – [illegible]o update service
  - Above a[illegible]ount deductible from first membership fees when manufacturer applies for membership within 6 months

- Open source clients – eibd daemon

TRUE FACTS ABOUT KNX/IP

- NO SECURITY
- EIBsec: a security extension to KNX/EIB
  - → 2006!!!!!!!!!
- New KNX specs (2013) claim security – but I can't read it – Anyone has 1000 euros?


ROOM 7777
GUEST NETWORK
KNXnet/IP
Router
192.178.1.4
2/2/2
2/2/3
KNX Network

GUEST NETWORK

KNXnet/IP
Router
192.178.1.4

ROOM 7777

2/2/2

2/2/3

KNX Network

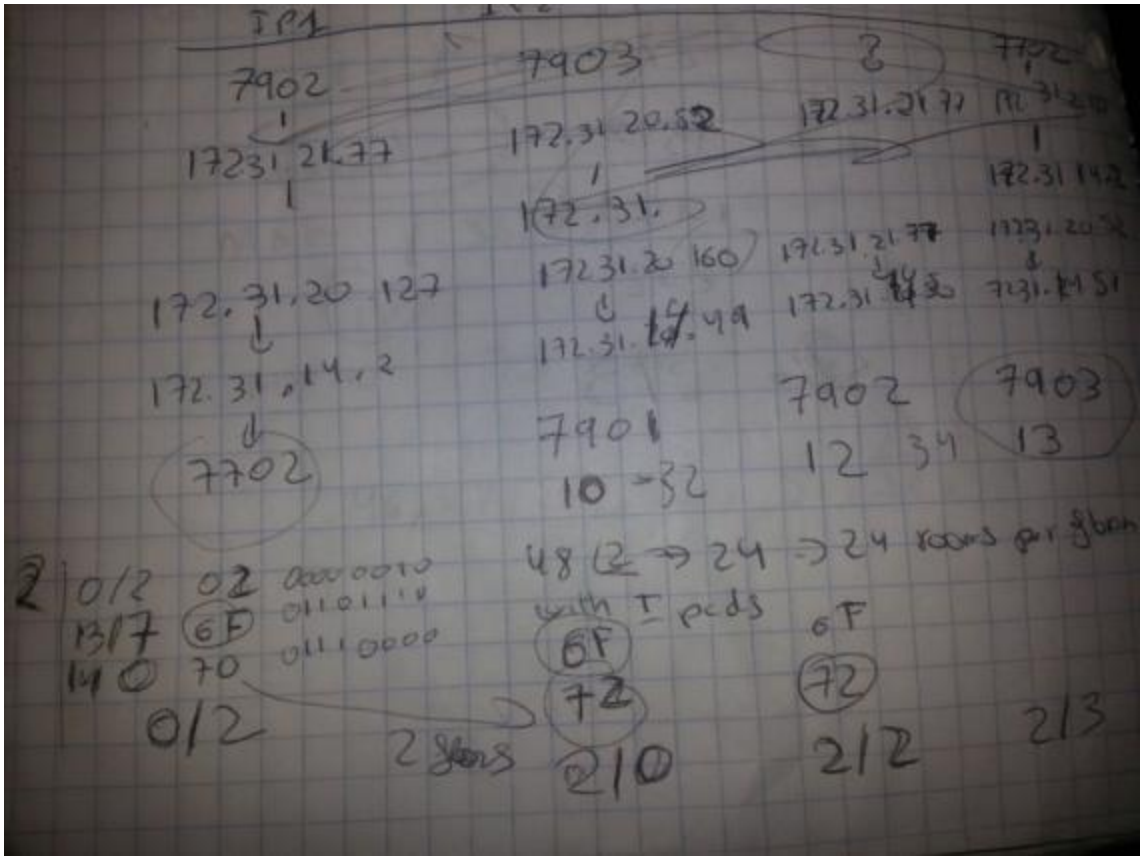
KNXnet/IP
Router
192.178.1.5

ROOM 7778

2/3/2

2/3/3

KNX Network


7902
7903
172.31.21.77
172.31.20.52
172.31.20.127
172.31.14.2
7702
7901
7902
7903
12 34
13
48 ⇒ 24 ⇒ 24
with 1 pods
6F
72
210
212
213
2 slots
0/2

KNX/IP router

KNX network

CONNECT_REQUEST

CONNECT_RESPONSE

CONNECTIONSTATE_REQUEST

CONNECTIONSTATE_RESPONSE

TUNNELLING_REQUEST

cEMI

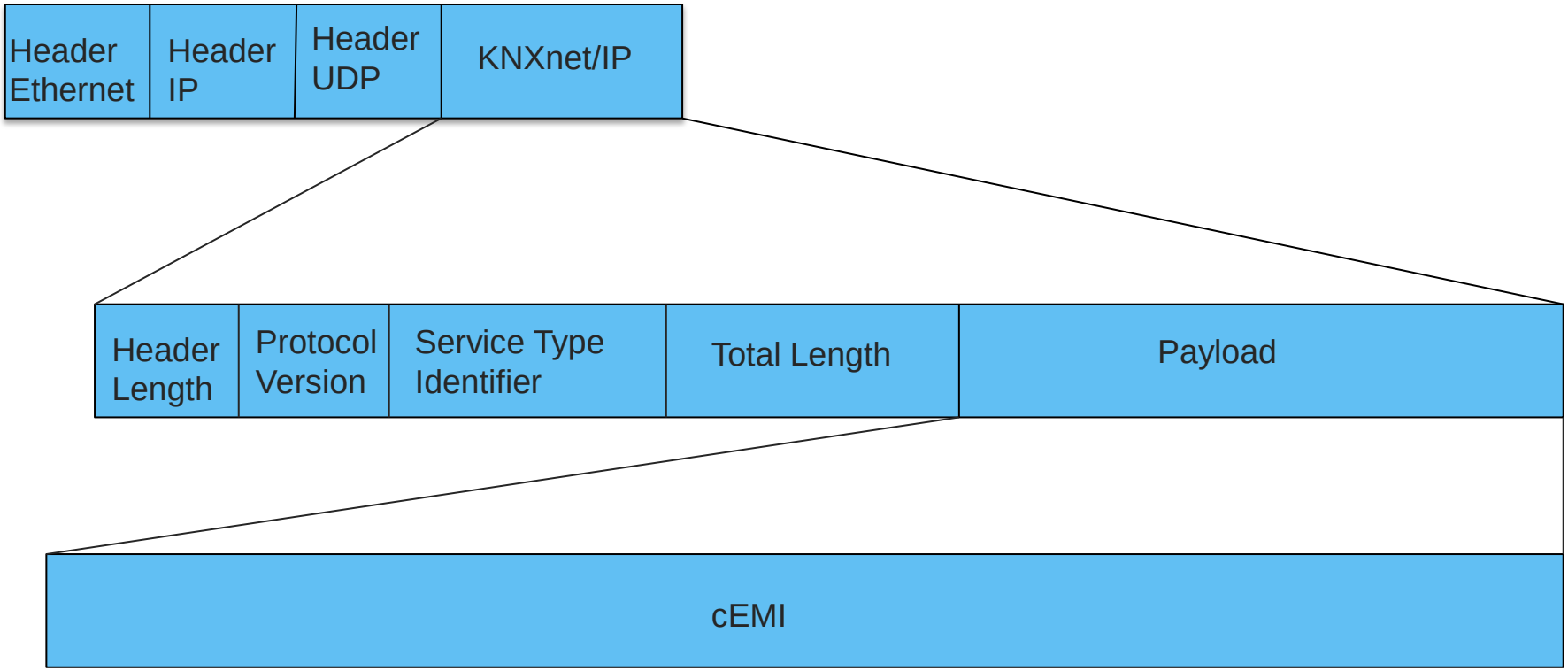
TUNNELLING_ACK

ACK

DISCONNECT_REQUEST

DISCONNECT_RESPONSE

KNX/IP frame




```
06 10 04 20 00 15 04 49 00 00 11 00 bc e0 00 00 08 02 01 00 81
```

A cEMI frame* to make a lightbulb go

```
/* TUNNELLING_REQUEST */
/* Header (6 Bytes) */
treq[0] = 0x06; /* 06 - Header Length */
treq[1] = 0x10; /* 10 - KNXnet version (1.0) */
treq[2] = 0x04; /* 04 - hi-byte Service type descriptor (TUNNELLING_REQUEST) */
treq[3] = 0x20; /* 20 - lo-byte Service type descriptor (TUNNELLING_REQUEST) */
treq[4] = 0x00; /* 00 - hi-byte total length */
treq[5] = 0x15; /* 15 - lo-byte total lengt 21 bytes */
/* Connection Header (4 Bytes) */
treq[6] = 0x04; /* 04 - Structure length */
treq[7] = iChannelID & 0xff; /* given channel id */
treq[8] = 0x00; /* sequence counter, zero if you send one tunnelling request only at
this session, otherwise count ++ */
treq[9] = 0x00; /* 00 - Reserved */
/* cEMI-Frame (11 Bytes) */
treq[10] = 0x11; /* message code, 11: Data Service transmitting */
treq[11] = 0x00; /* add. info length ( bytes) */
treq[12] = 0xbc; /* control byte */
treq[13] = 0xe0; /* DRL byte */
treq[14] = 0x00; /* hi-byte source individual address */
treq[15] = 0x00; /* lo-byte source (replace throw IP-Gateway) */
treq[16] = (destaddr >> 8) & 0xff; /* hi-byte destination address (20: group address)
4/0/0: (4*2048) + (0*256) + (0*1) = 8192 = 20 00 */
treq[17] = destaddr & 0xff; /* lo-Byte destination */
treq[18] = 0x01; /* 01 data byte following */
treq[19] = 0x00; /* tpdu */
treq[20] = 0x81; /* 81: switch on, 80: off */
```

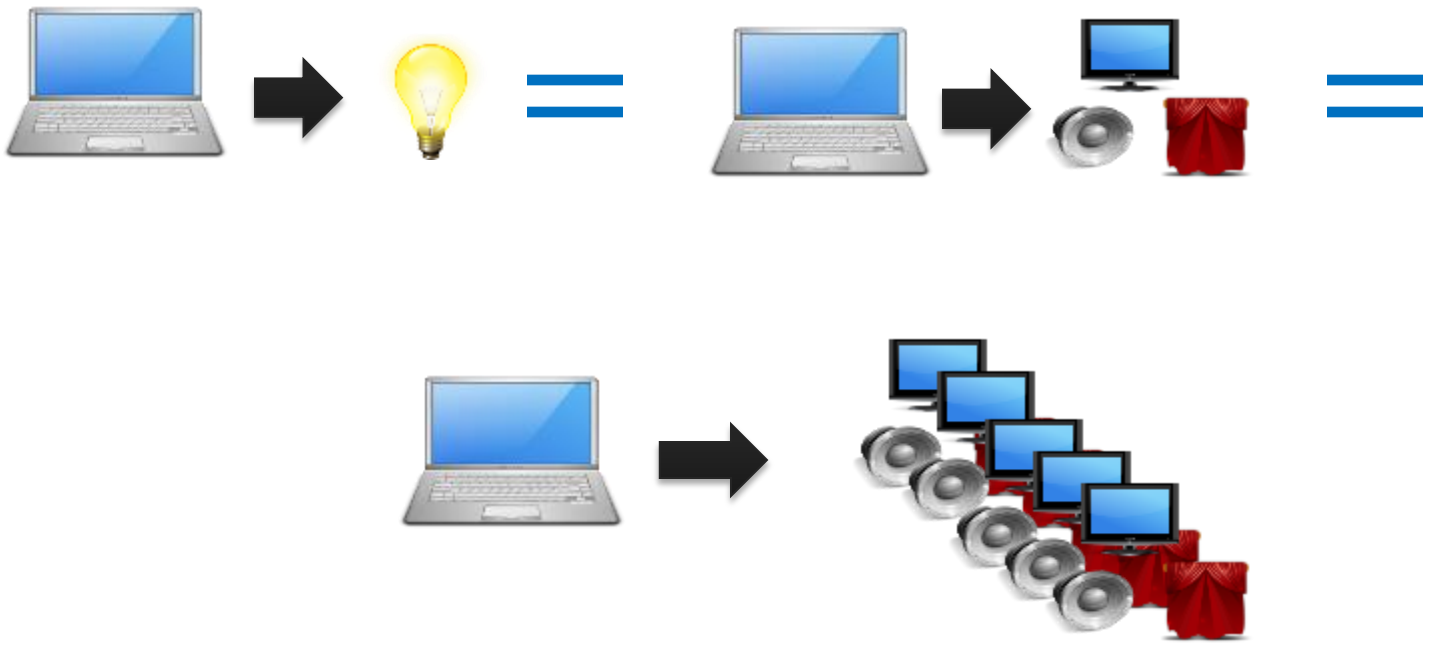
Address

Action

*According to http://www.eb-systeme.de/

EVALUATIONS

Can I switch TV on in EVERY room?

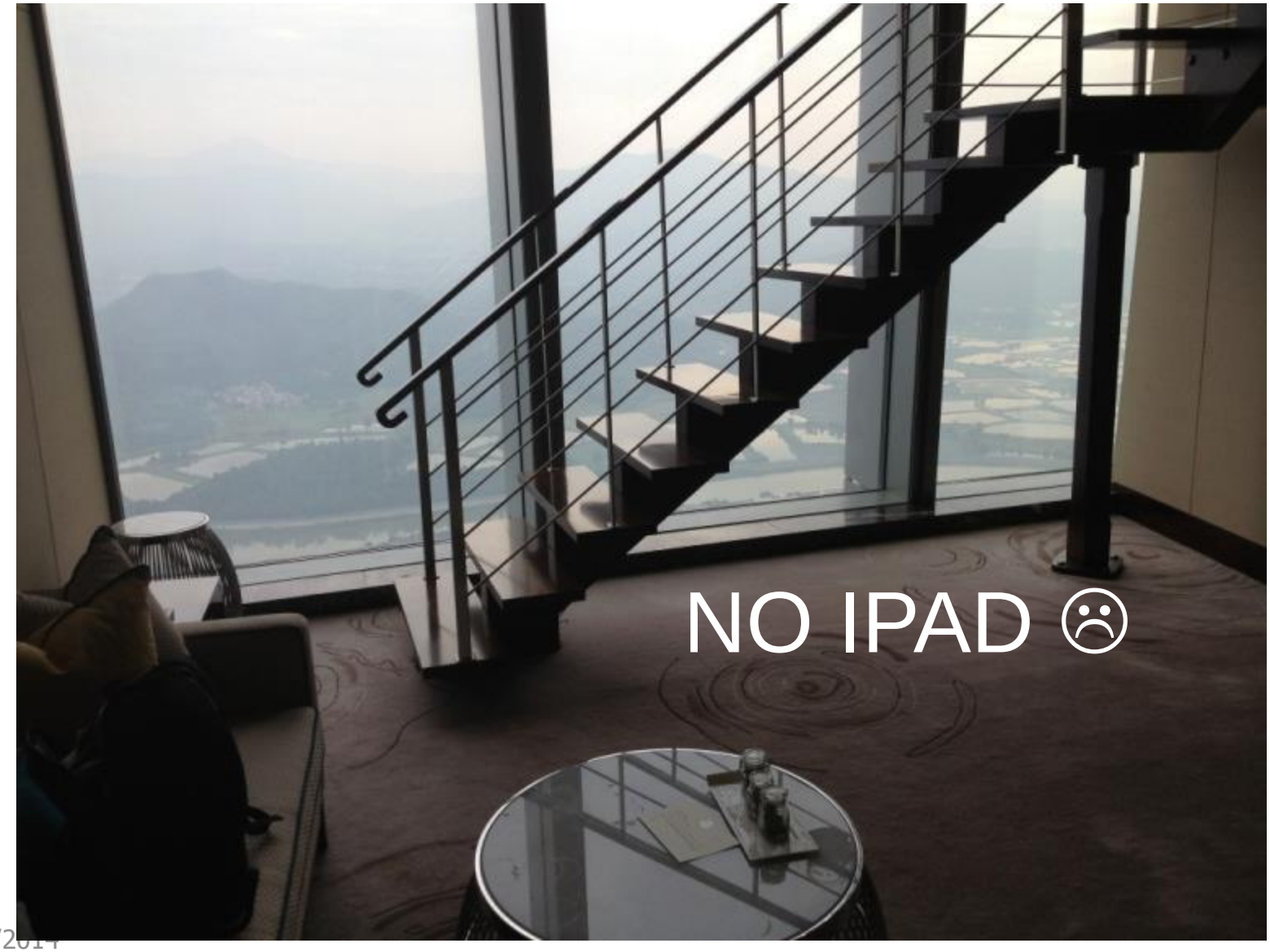


“Let There Be Light”

COLLECTING INFORMATION

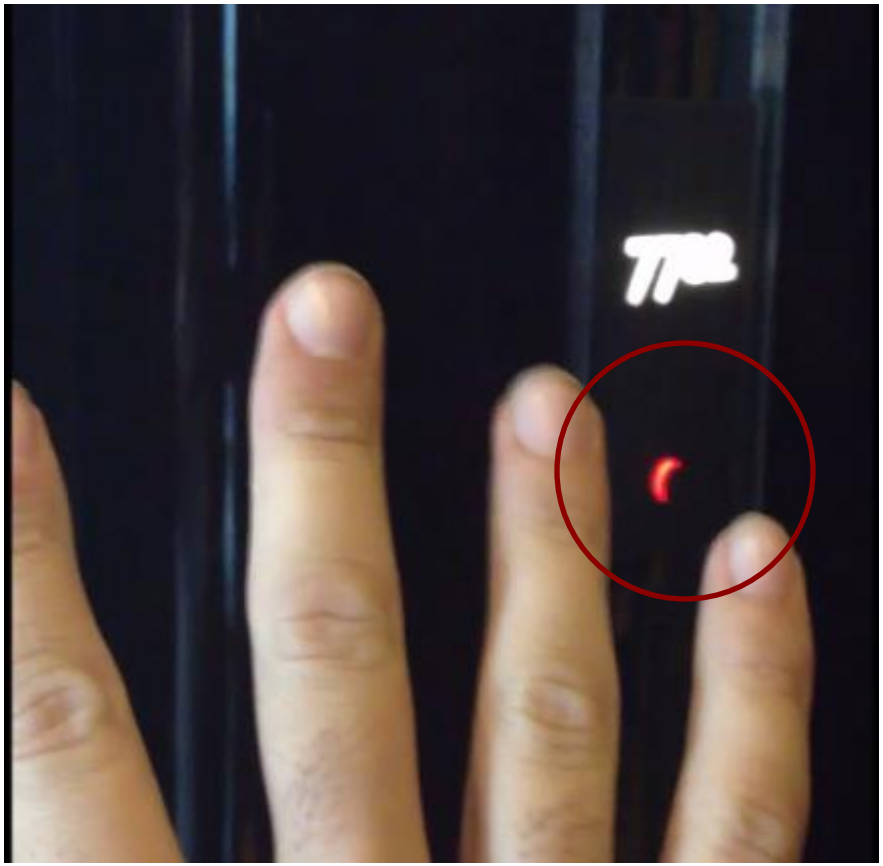
- Program to send tunneling request
  - Code your own
  - Eibd: http://www.auto.tuwien.ac.at/~mkoegler/index.php/eibd
- KNX Address of each device in the room
  - Press the iPad and automate collecting the result
- IP address and KNX of each room
  - Change rooms and infer the pattern

INFORMATION COLLECTION FAILURE



How do I know it works?

- DND Lights are outside the room…
- And I control them! DND heartbeat



Where there other things connected?

MAYBE – But I got Scared ☹

WHAT DOES IT MEAN?

For Hotels

- Update security policies according to new technologies
- Open protocols and security for external researchers
- Guest security cannot be an afterthought
- Is this possible in other hotels?

For the IoT

- Guerrilla war when it comes to deployment
- KNX is a standard for home automation!
- Most protocols are closed
- Most protocols rely in external security
- Extra care when deploying automation in shares spaces

So What? What's the worst thing that could happen?

"One iPad to rule them all"

"The **humans** have played their hand"

If I were to tell someone is able to control every appliance in your hotel room, will you move to another hotel tonight?

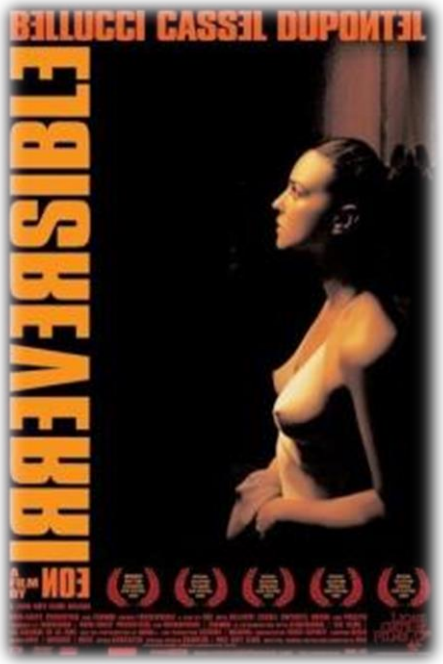
The worst thing that could happen is that we don’t care. Welcome to 2084

Questions?

security@nomeames.com

@verifythentrust


MEMENTO
GUY PEARCE CARRIE-ANNE MOSS JOE PANTOL
"A masterpiece!"


IRREVERSIBLE
BELLUCCI CASSEL DUPONTEL

THE STORY

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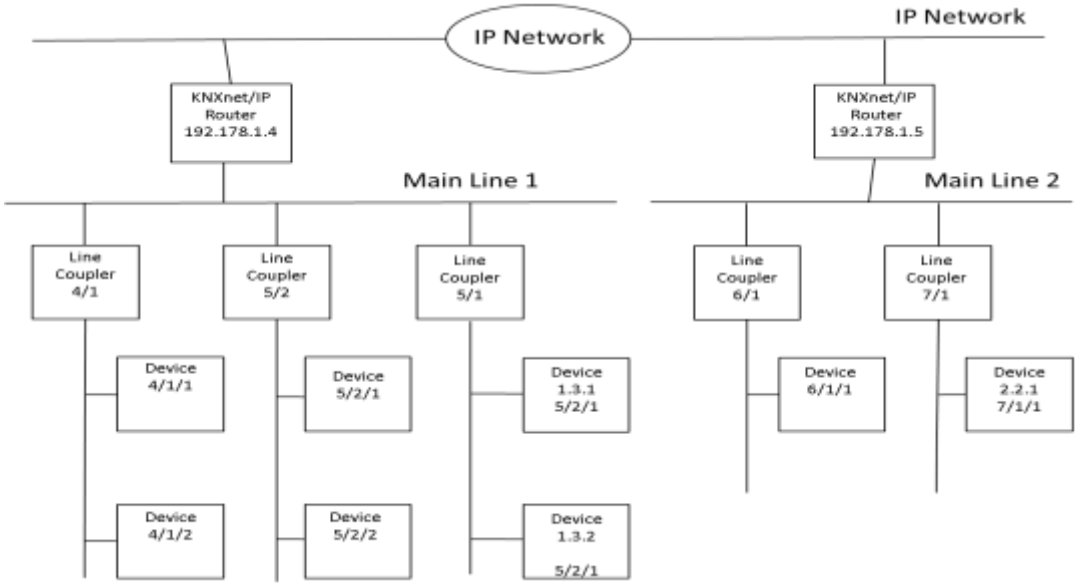
*According to http://www.eb-systeme.de/

KNX/IP Sample Network

- Addresses are in the format Area/Line/Device in KNX
- The KNX ShenZhen network works in tunnel mode



The Elephant in the Hotel Room

- I was a guest at the hotel, not a planned security evaluation
- Limited time and resources
- Fear of making a bad mistake
- I **did not** hack anything
- Does not matter if you get caught