Powerlib

an online database on power consumption of ICT network equipment

Ward Van Heddeghem

ward.vanheddeghem@intec.ugent.be

www.ibcn.intec.ugent.be
Internet Based Communication Networks and Services (IBCN)
Department of Information Technology (INTEC)
Ghent University - iMinds

Outline

1. Why a powerlib database ?

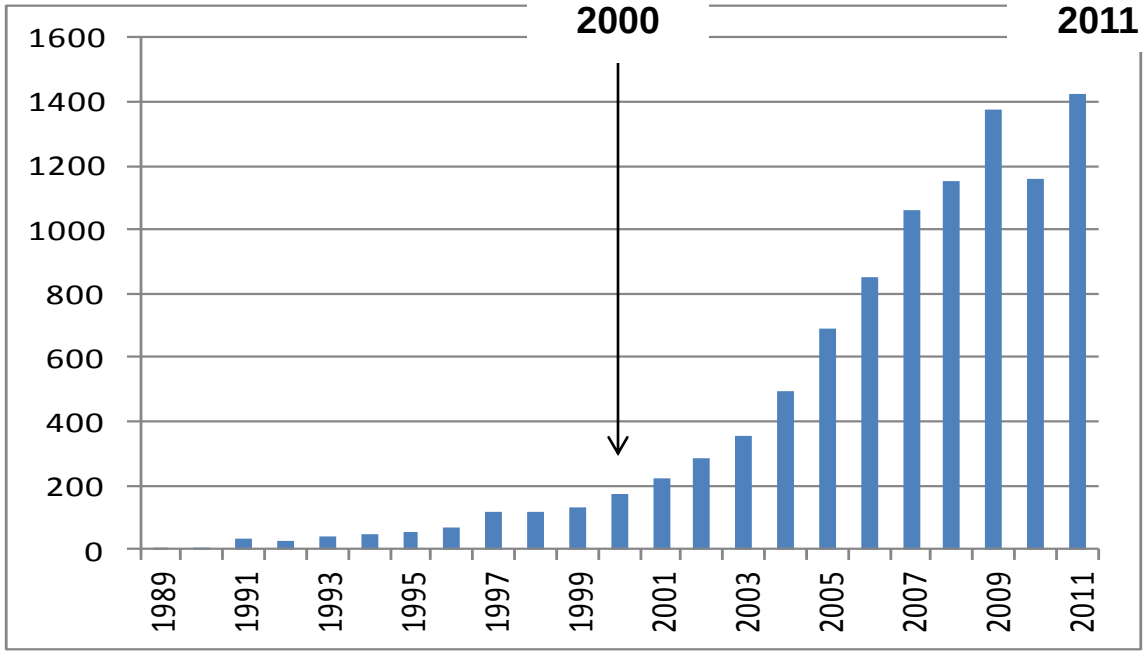
2. Short overview of powerlib website (screenshots)

3. Outlook and lessons learned

What is the problem?

- Increasing number **energy-efficient networks papers**, see →

- Important to have **good reference power values** for network equipment.



Source: **WebOfScience**
Topic=((**green** OR "**energy efficient**" OR "**energy-efficient**") AND **network***)

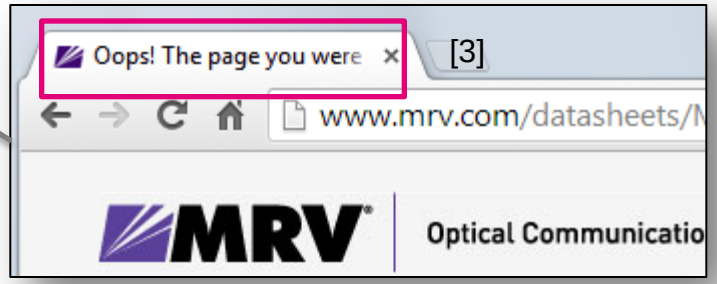
What is the problem?

- Many types of network devices: (routers, amplifiers, …)
- **Problem 1:** → **many different values** used in publications
- **Problem 2:** → **value scope ?**
- **Problem 3:** → **references** often **vague/not traceable/obsolete**

Example, **optical amplifier**:
- in [1]: 8 W / amplifier
- in [2]: 1000 W / amplifier

→ **> 100 x !**

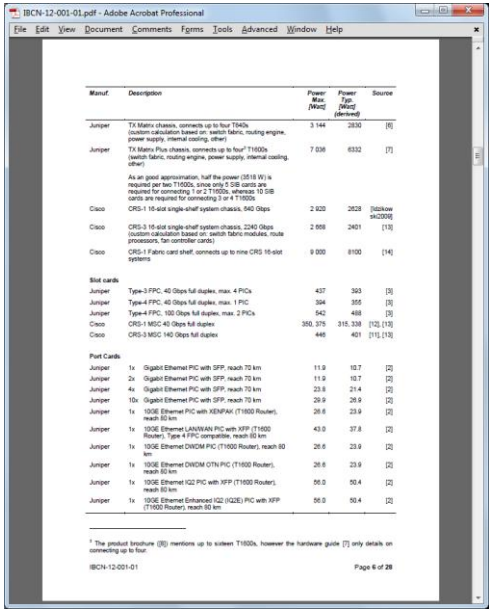
Only core functionality?
System overhead included?
Typical/maximum/rated?



[1]: Shen, JOCN, 2009, http://dx.doi.org/10.1364/JOCN.1.000176
[2]: Chiaraviglio, ICC workshop, 2009 http://dx.doi.org/10.1109/ICCW.2009.5208038
[3]: A. Coiro, JSTQE 2011, http://dx.doi.org/10.1109/JSTQE.2010.2052791

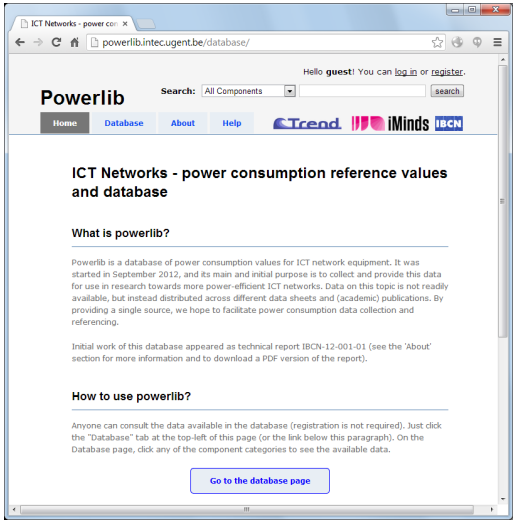
What is the problem?

- **Goal:** collect representative data for major network equipment (routers, OLAs, transponders, …)



- Available in **PNET paper** and in **report** (IBCN-12-001-01)

- And eventually a public, online database: **powerlib**

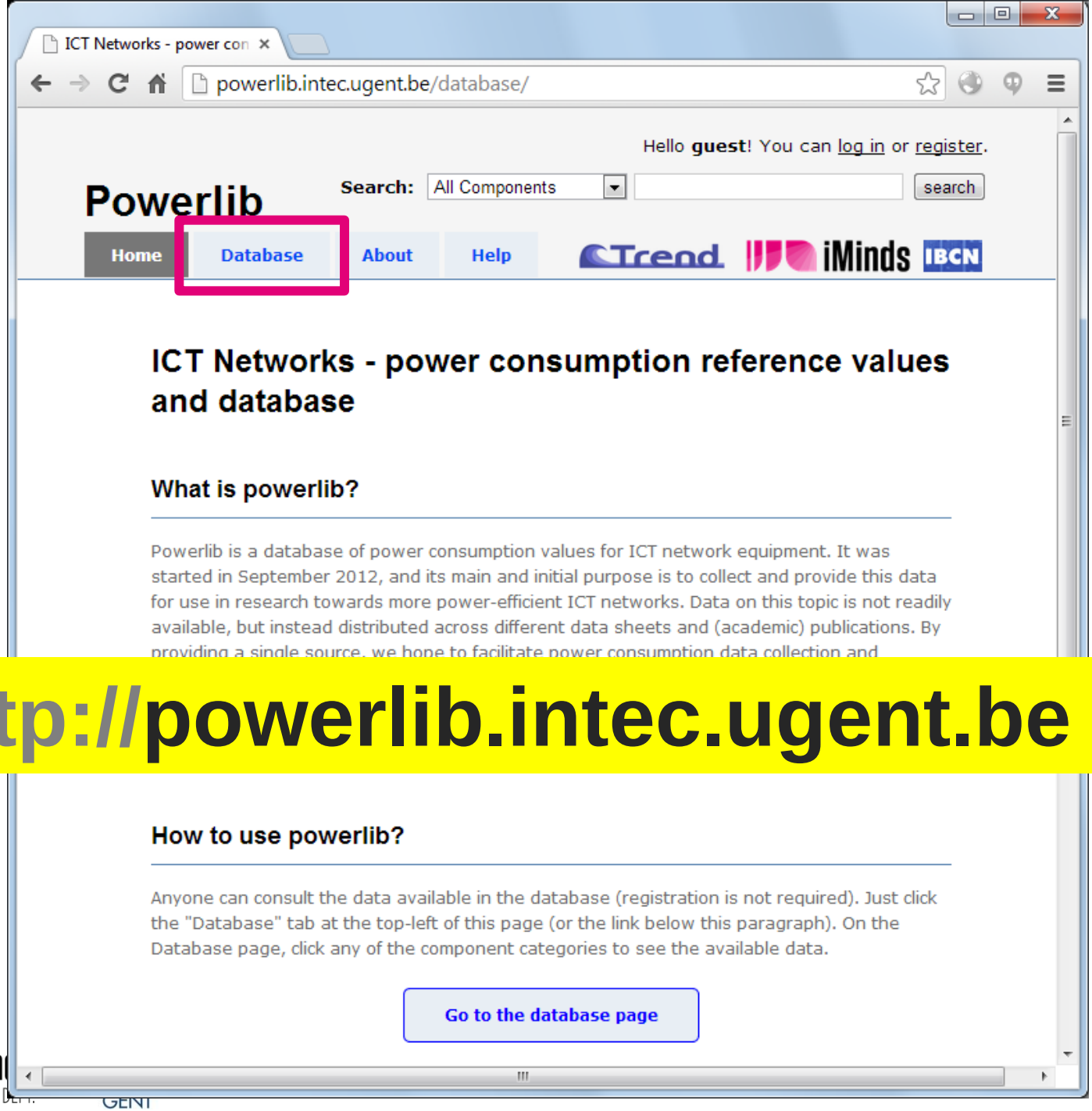


W. Van Heddeghem etal., "*Power consumption modeling in optical multilayer networks*", Photonic Network Communications (2012), DOI: 10.1007/s11107-011-0370-7

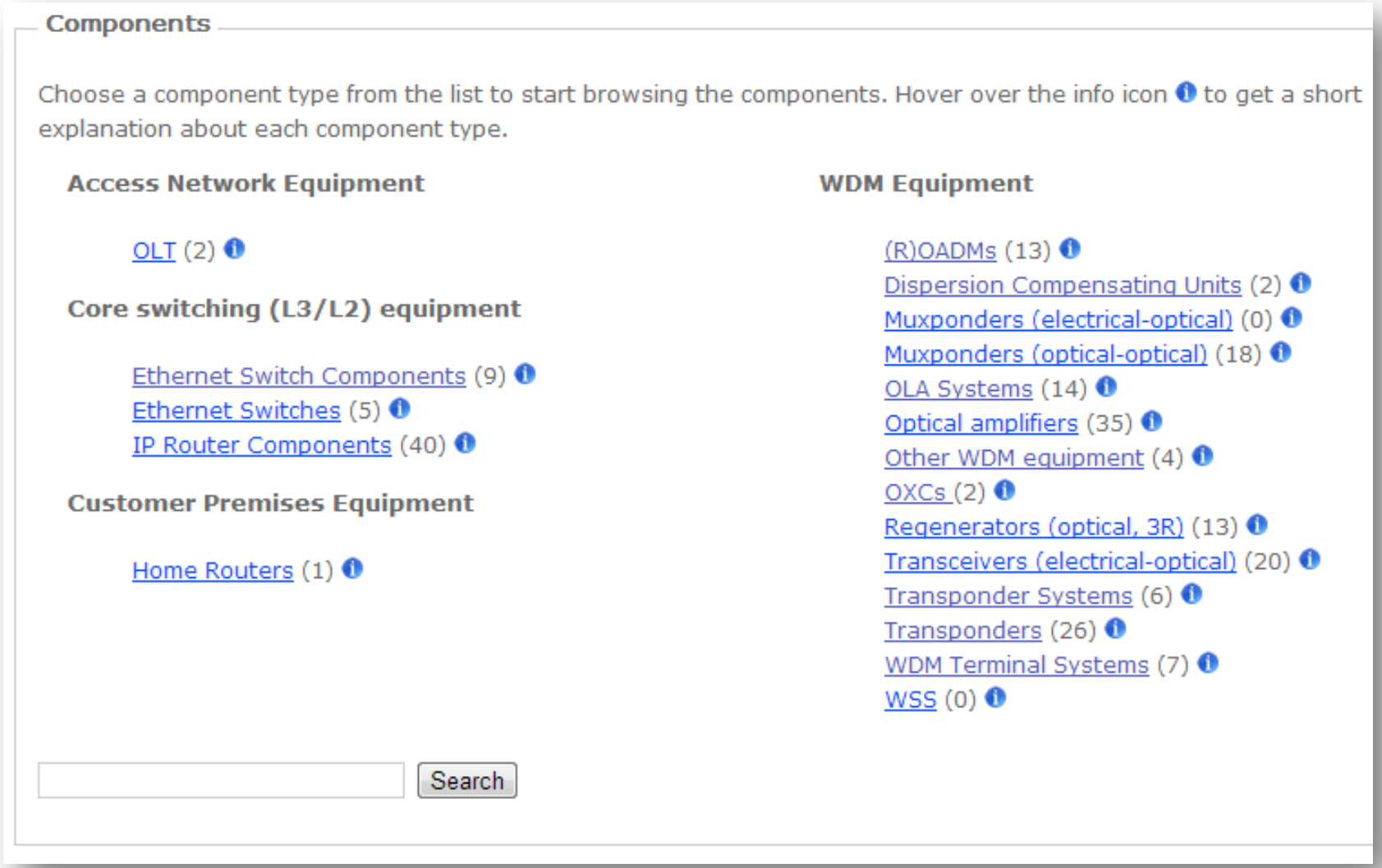
Powerlib database features

- Data:
  - **publicly accessible**
  - Specifies **scope**
    (e.g. includes overhead of chassis, fans, …)
  - Based mostly on **publicly available sources**
    (product data sheets); includes source link.
  - *Currently* limited to backbone network equipment

- **Registered** users can **:**
  - **Contribute** new data
  - **Download** original source (**PDF**)



http://powerlib.intec.ugent.be


Components
Choose a component type from the list to start browsing the components. Hover over the info icon to get a short explanation about each component type.
Access Network Equipment
OLT (2)
Core switching (L3/L2) equipment
Ethernet Switch Components (9)
Ethernet Switches (5)
IP Router Components (40)
Customer Premises Equipment
Home Routers (1)
WDM Equipment
(R)OADMs (13)
Dispersion Compensating Units (2)
Muxponders (electrical-optical) (0)
Muxponders (optical-optical) (18)
OLA Systems (14)
Optical amplifiers (35)
Other WDM equipment (4)
OXCs (2)
Regenerators (optical, 3R) (13)
Transceivers (electrical-optical) (20)
Transponder Systems (6)
Transponders (26)
WDM Terminal Systems (7)
WSS (0)
Search

Navigate to Transponder Systems Go

List of Component type : Transponder Systems

Export to csv file

	Manufacturer	System Name	Additional Info & Computation Description	Cap (Gbps)	Pwr [R] unsp (Watt)	Pwr [R] typ (Watt)	Pwr [R] max (Watt)	Pwr PNET (Watt)	Source	Source Type	Last modification
Details	Fujistsu	Flashwave 7200, Tunable Optical Transponder Solution	2.5G transponder (ANSI shelf), including overhead *ANSI shelf: 381 W typical for 16 2.5G transponders (OC-48/STM-16). mgmt shelf: 215 W typical fully populated . Per transponder: (381+215)/16 = 37.2 W*	2.5	-	37.2	-	37.2	[26]	Datasheet	2012/07/11 13:26:34
Details	Fujistsu	Flashwave 7200, Tunable Optical Transponder Solution	10G transponder (ANSI shelf), including overhead *ANSI shelf: 333 W typical for 8 10G transponders (OC-192/STM-64)). mgmt shelf: 215 W typical fully populated. Per transponder: (333+215)/8 = 68.5 W*	10	-	68.5	-	68.5	[26]	Datasheet	2012/07/11 13:26:34

List of sources

	Source ID	Author or Manufacturer	Title	Date	Remark	Source Type	Link	Last modification
Details	24	Juniper	EX8200 Ethernet Line Cards datasheet	2011-09		Datasheet	link	2012/07/11 13:26:34
Details	25	Cisco	Nexus 7000 32-Port 1 and 10 Gigabit Ethernet Module datasheet	2011-03		Datasheet	link	2012/07/11 13:26:34
Details	26	Fujitsu	Flashwave 7200	2002-03		Datasheet	link	2012/08/09 08:32:37
Details	27	Fujitsu	Flashwave 7300	2002-03		Datasheet	link	2012/08/09 08:33:04
Details	28	Ciena	F10-T 10G Transponder Module	2010-10		Datasheet	link	2012/07/11 13:26:34

iMinds FUTURE INTERNET DEPT.

UNIVERSITEIT GENT

http://powerlib.intec.ugent.be

Details of component

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Component Info

Type	OLA Systems
System Name	Common Photonic layer
System Family	Common Photonic Layer
Manufacturer Code	-
Manufacturer	Ciena
Additional Info	Fully filled Line Amplification site (88 wavelengths) = 95 W (0.1 rack)
Computation Description	Probably bidirectional because for other 'sites' it always mentions specifically that it is 'per direction'
Remark	-

Specifications

Power rated (unspecified)	-	*Power rated, unspecified operation mode*
Power rated (typical)	95 Watt	*Power rated, typical operation mode*
Power rated (maximum)	-	*Power rated, maximum*
Power PNET	95 Watt	*Power value used in PNET paper*

Available specs depend on type of equipment

Sources

[42] Datasheet - Ciena - Common Photonic Layer

Metadata

Last modified user	HIDDEN FOR UNREGISTERED USERS AND READERS
Last modified time	2012/07/11 13:26:34

Source details

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Edit
Delete

Source ID	42
Author or manufacturer	Ciena
Title	Common Photonic Layer
Publication Date	2011-08
Remark	-
Source Type	Datasheet
Link	http://media[illegible].com/documents/Common_Photonic_Layer_DS.pdf
Attached File	http://powerlib.intec.ugent.be/database/uploads/Common_Photonic_Layer_DS_1344501456.p

Linked components: 109.

PDF available for registered users

Future of powerlib?

- Fall 2013:
  - **add access equipment** (xPONs, etc.) data
- Beyond 2013:
  - **Update it yearly**
  - Hopefully in 5 years or so, we have some historical data
- We are **open for collaboration** with other initiatives.
- If you'd like to contribute, register at the site.

Bigger picture (1/2)

- Collection of data not easy:
  - Many **vendors don't (like to) share** power consumption data
  - And those that do probably focus more on energy-efficiency, so **sample might be biased**.
  - Unclear/incomplete **data sheets**

Example: netgear home router

ON - WNDR3800 DATA SHEET

NETGEAR Green Features

- 80% Recycled Packaging
- CEC (California Efficiency)
- RoHS
- WEEE
- Power On/Off Button
- Wireless On/Off Button
- Wireless Output Power Manageme
- Port Auto Power Down
- Cable Length Power Save

Nice features !!

But actual power consumption (Watt)?

Power adapter: 12V DC @ 2.5A is all we get

Technical Specifications

Table 5. WNDR3800 Router Specifications

Feature	Specification
Data and routing protocols	TCP/IP, RIP-1, RIP-2, DHCP, PPPoE, PPTP, Bigpond, Dynamic DNS, UPnP, and SMB
Power adapter	• North America: 120V, 60 Hz, input • UK, Australia: 240V, 50 Hz, input • Europe: 230V, 50 Hz, input • All regions (output): 12V DC @ 2.5A, output
Dimensions	223 x 153 x 31 mm (8.8 x 6.0 x 1.2 in)
Weight	0.5 kg (1.2 lb)

[1] http://www.netgear.com/images/WNDR3800_DS_04Oct1118-17620.pdf
[2] http://www.myaccount.charter.com/customers/GETBINARY.xbin?ID=3220

Bigger picture (2/2)

- What is needed (IMO):
  - Make it **obligatory to disclose** power consumption (e.g. in data sheets)
  - We need to specify a **basic set of required data** (e.g. power at standby, typical load, full load)
  - Would be nice if there was a **single, worldwide repository.** Good for:
    - Researchers/policy makers → track trends
    - Policy maker → set standards
    - Customers → prospection

Questions ?

Ward Van Heddeghem

ward.vanheddeghem@intec.ugent.be

http://www.ibcn.intec.ugent.be/content/green-ict

http://powerlib.intec.ugent.be

Layers

- Layering is based on NOBEL layering [1]

- IP/MPLS layer → L3 switching
- Ethernet layer → L2 switching
- (SDH)/OTN layer → L1 Time Div Mux'ing and monitoring
- WDM layer → L1 Space Div Mux'ing and transmission
  - Transponders/ muxponders
  - Regenerators
  - OLAs
  - WDM terminals
  - ROADMs / OXCs

[1] Huelsermann, "Cost modeling and evaluation of capital expenditures in optical multilayer networks," *JON*, 2008, http://dx.doi.org/10.1364/JON.7.000814