

# Powerlib

an online database on  
power consumption of  
ICT network equipment



**Ward Van Heddeghem**

[ward.vanheddeghem@intec.ugent.be](mailto:ward.vanheddeghem@intec.ugent.be)

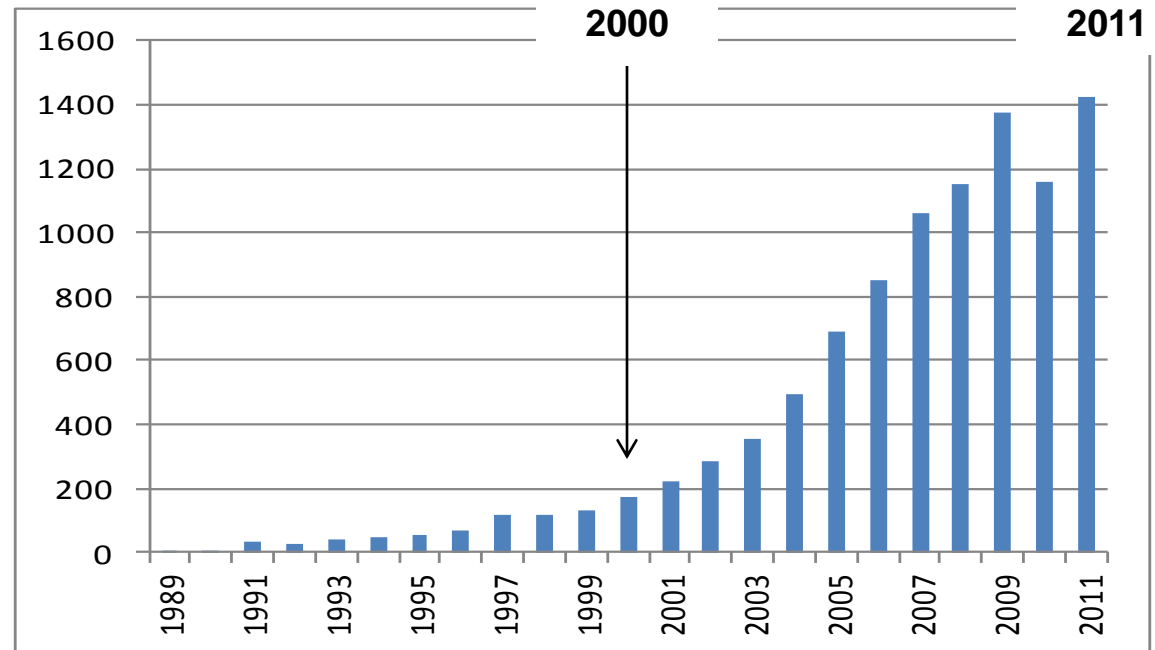
[www.ibcn.intec.ugent.be](http://www.ibcn.intec.ugent.be)  
Internet Based Communication  
Networks and Services (IBCN)  
Department of Information Technology  
(INTEC)  
Ghent University - iMinds

# 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, ...)

Example, **optical amplifier**:

- in [1]: 8 W / amplifier
- in [2]: 1000 W / amplifier

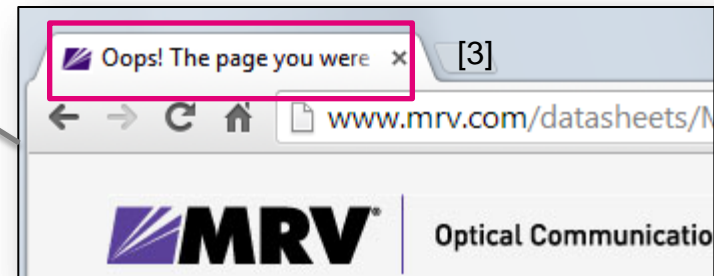
**➔ > 100 x !**

- **Problem 1:** ➔ **many different values** used in publications

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

- **Problem 2:** ➔ **value scope ?**

- **Problem 3:** ➔ **references often vague/not traceable/obsolete**



# 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**

Manufacturer	Description	Power Max (Watt)	Power Typ (Watt)	Source
Juniper	Tx Matrix chassis, connects up to four T1000s (location calculation based on switch fabric, routing engine, power supply, internal cooling, other)	3 144	2030	[6]
Juniper	Tx Matrix Plus chassis, connects up to four T1000s (switch fabric, routing engine, power supply, internal cooling, other)	7 038	6332	[7]
As a good approximation, half the power (3518 W) is required per two T1000s, since only 2 SSB cards are required for connecting 1 or 2 T1000s, whereas 10 SSB cards are required for connecting 3 or 4 T1000s.				
Cisco	CRS-1 16 slot single-shelf system chassis, 940 Slots	2 600	2028	[2] (below 140000)
Cisco	CRS-3 16 slot single-shelf system chassis, 2240 Slots (location calculation based on switch fabric modules, route processors, fan controller cards)	2 608	2401	[13]
Cisco	CRS-1 Fabric card shelf, connects up to nine CRS-16 slot systems	9 800	9100	[14]
<b>Slot cards</b>				
Juniper	Type-3 FPC, 40 Slots full duplex, max. 4 FPCs	437	363	[5]
Juniper	Type-4 FPC, 40 Slots full duplex, max. 1 FPC	354	305	[5]
Juniper	Type-5 FPC, 100 Slots full duplex, max. 2 FPCs	642	488	[5]
Cisco	CRS-1 MSC-40 Slots full duplex	360, 375	315, 338	[12], [13]
Cisco	CRS-3 MSC-140 Slots full duplex	496	401	[11], [13]
<b>Port Cards</b>				
Juniper	1x Digital Ethernet PIC with SFP, reach 75 km	11.9	10.7	[2]
Juniper	2x Digital Ethernet PIC with SFP, reach 75 km	11.9	10.7	[2]
Juniper	4x Digital Ethernet PIC with SFP, reach 75 km	23.8	21.4	[2]
Juniper	10x Digital Ethernet PIC with SFP, reach 75 km	29.9	26.9	[2]
Juniper	1x 100G Ethernet PIC with XENPAK (T1000 Router), reach 80 km	28.8	23.9	[2]
Juniper	1x 100G Ethernet LANPAK PIC with SFP (T1000 Router), Type 4 FPC compatible, reach 80 km	43.0	37.8	[2]
Juniper	1x 100G Ethernet DNDM PIC (T1000 Router), reach 80 km	26.6	23.9	[2]
Juniper	1x 100G Ethernet DNDM OTN PIC (T1000 Router), reach 80 km	28.6	23.9	[2]
Juniper	1x 100G Ethernet Q2 PIC with XFP (T1000 Router), reach 80 km	56.0	50.4	[2]
Juniper	1x 100G Ethernet Enhanced Q2 (Q2E) PIC with XFP (T1000 Router), reach 80 km	56.0	50.4	[2]

1 The product brochure [6] mentions up to sixteen T1000s, however the hardware guide [7] only details on connecting up to four.  
IBCN-12-001-01 Page 6 of 28

ICT Networks - power consumption reference values and database

What is powerlib?

Powerlib is a database of power consumption values for ICT network equipment. It was started in September 2012, and its main and initial purpose is to collect and provide this data for use in research towards more power-efficient ICT networks. Data on this topic is not readily available, but instead distributed across different data sheets and (academic) publications. By providing a single source, we hope to facilitate power consumption data collection and referencing.

Initial work of this database appeared as technical report IBCN-12-001-01 (see the 'About' section for more information and to download a PDF version of the report).

How to use powerlib?

Anyone can consult the data available in the database (registration is not required). Just click the "Database" tab at the top-left of this page (or the link below this paragraph). On the Database page, click any of the component categories to see the available data.

[Go to the database page](#)

# 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**)

The screenshot shows a web browser window with the URL [powerlib.intec.ugent.be/database/](http://powerlib.intec.ugent.be/database/). The page header includes the Powerlib logo, a search bar with a dropdown menu set to 'All Components', and a 'search' button. A navigation menu contains 'Home', 'Database', 'About', and 'Help' tabs, with 'Database' highlighted in a pink box. The main content area features the title 'ICT Networks - power consumption reference values and database', followed by a section 'What is powerlib?' and a paragraph explaining the database's purpose. A yellow banner at the bottom of the page displays the URL <http://powerlib.intec.ugent.be>. Below this, a section 'How to use powerlib?' provides instructions on how to access the data, and a blue button labeled 'Go to the database page' is positioned at the bottom of the content area.

## 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

## 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
<a href="#">Details</a>	Fujitsu	Flashwave 7200, Tunable Optical Transponder Solution	2.5G transponder (ANSI shelf), including overhead <i>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</i>	2.5	-	37.2	-	37.2	<a href="#">[26]</a>	Datasheet	2012/07/11 13:26:34
<a href="#">Details</a>	Fujitsu	Flashwave 7200, Tunable Optical Transponder Solution	10G transponder (ANSI shelf), including overhead <i>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</i>	10	-	68.5	-	68.5	<a href="#">[26]</a>	Datasheet	2012/07/11 13:26:34

## List of sources

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

## Details of component

[Back to List](#)

### Component Info

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

### Specifications

<b>Power rated (unspecified)</b>	-	<i>Power rated, unspecified operation mode</i>
<b>Power rated (typical)</b>	95 Watt	<i>Power rated, typical operation mode</i>
<b>Power rated (maximum)</b>	-	<i>Power rated, maximum</i>
<b>Power PNET</b>	95 Watt	<i>Power value used in PNET paper</i>

Available specs depend on type of equipment

### Sources

[42] Datasheet - Ciena - Common Photonic Layer

### Metadata

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

## Source details

[Back to List](#)

[Edit](#)

[Delete](#)

<b>Source ID</b>	42
<b>Author or manufacturer</b>	Ciena
<b>Title</b>	Common Photonic Layer
<b>Publication Date</b>	2011-08
<b>Remark</b>	-
<b>Source Type</b>	Datasheet
<b>Link</b>	<a href="http://media.ciena.com/documents/Common_Photonic_Layer_DS.pdf">http://media.ciena.com/documents/Common_Photonic_Layer_DS.pdf</a>
<b>Attached File</b>	 <a href="http://powerlib.intec.ugent.be/database/uploads/Common_Photonic_Layer_DS_1344501456.p">http://powerlib.intec.ugent.be/database/uploads/Common_Photonic_Layer_DS_1344501456.p</a>

**PDF available  
for registered users**

Linked components: [109](#).

# 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 Management
- 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	<ul style="list-style-type: none"><li>• North America: 120V, 60 Hz, input</li><li>• UK, Australia: 240V, 50 Hz, input</li><li>• Europe: 230V, 50 Hz, input</li><li>• All regions (output): <b>12V DC @ 2.5A, output</b></li></ul>
Dimensions	223 x 153 x 31 mm (8.8 x 6.0 x 1.2 in)
Weight	0.5 kg (1.2 lb)

# 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](mailto:ward.vanheddeghem@intec.ugent.be)

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



# 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