Opportunities for Power Savings in Optical Access

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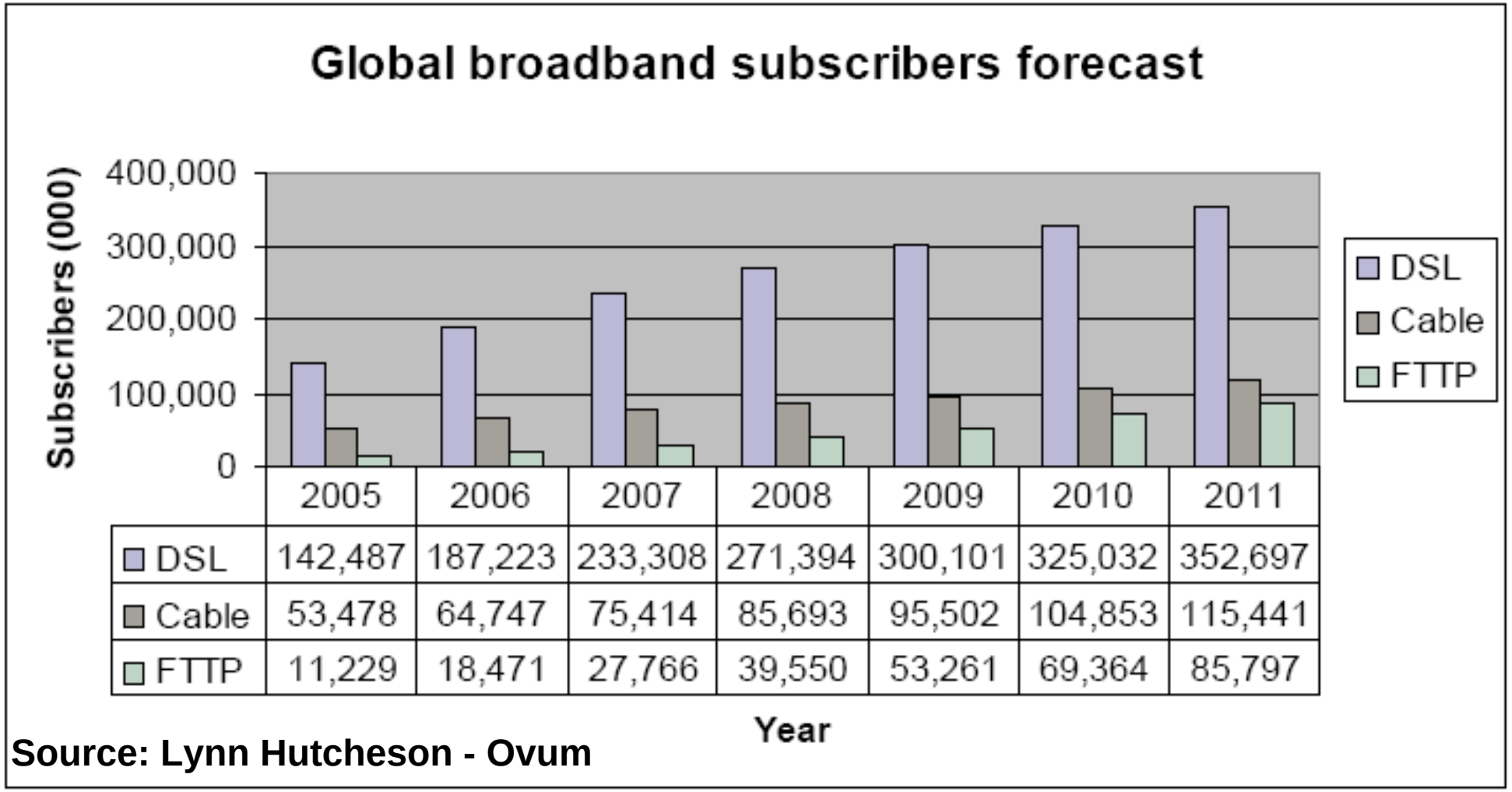
- **www.huawei.com**

Outline

- **Importance of the problem**
- **Service environment**
- **What can we do?**
- **Next steps**

Optical access growth



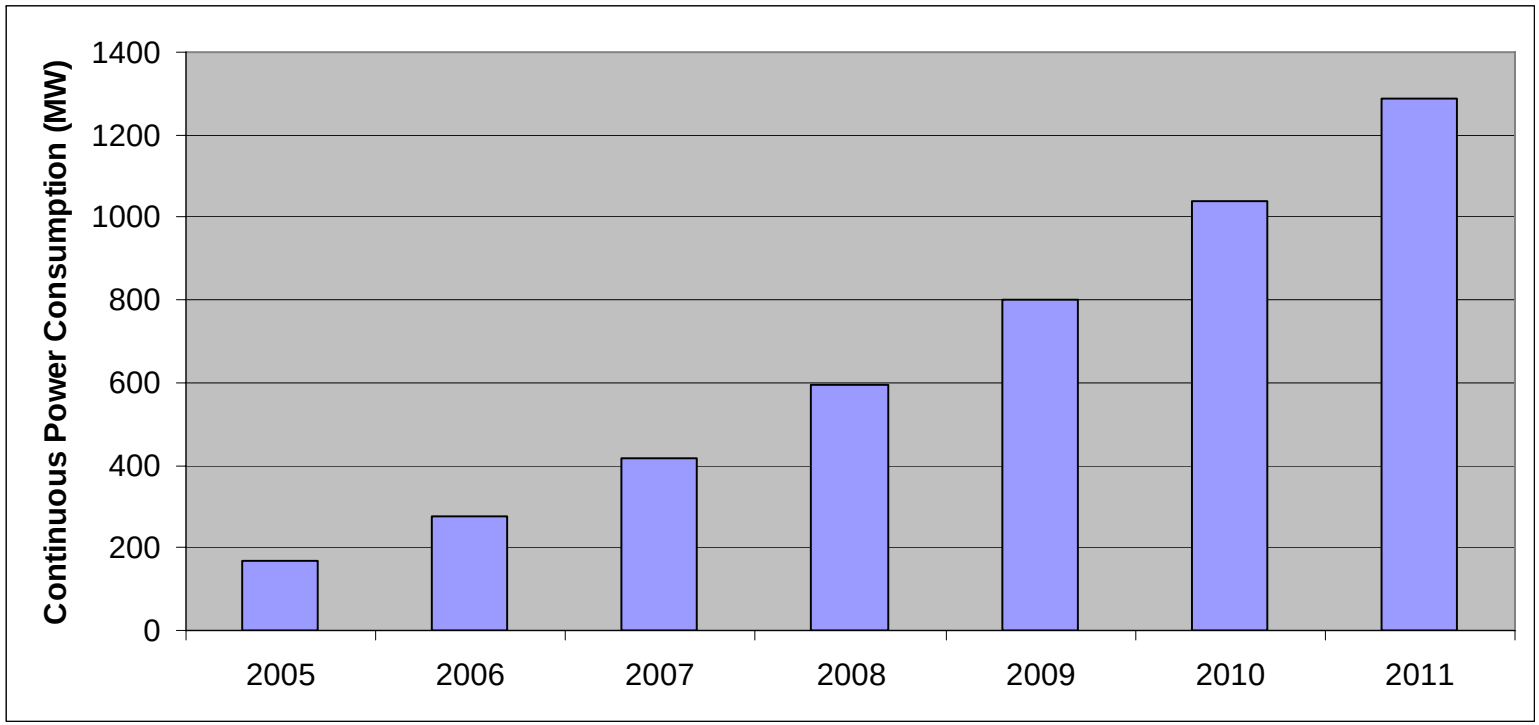
	2005	2006	2007	2008	2009	2010	2011
DSL	142,487	187,223	233,308	271,394	300,101	325,032	352,697
Cable	53,478	64,747	75,414	85,693	95,502	104,853	115,441
FTTP	11,229	18,471	27,766	39,550	53,261	69,364	85,797

Source: Lynn Hutcheson - Ovum

- **By 2011, over 80M homes will have FTTP**

Power footprint of Optical Access Networks

- **Outlook for power consumption**
  - OLT consumes ~1500W, serves ~1500 homes on average
  - Per customer ONU consumes ~15W



- **2011 energy consumption of 11 TWhr, equal to 7M tons of CO_2**
  - That's about three extra 500MW power stations

FTTH Power paradigm shift

- **For a century, telco sent power over the wires**
- **FTTH changes all that!**
  - Local power, distributed batteries, paid (and serviced) by the user
- **Several surveys in Q2 have told us that**
  - Governments and regulations have not caught up to reality
    - However, a variety of regulations are being introduced
  - Opinions on the general concepts of “powering” are diverse
    - Variations over the regions of the world
    - Variations in the business approach
- **Bottom line: situation is unsettled**

Telecom's Hippocratic Oath: First do no harm

- **Network operators are afraid to impact service quality, even for a good cause**
  - Lifeline service commitments to regulator
  - Liability for damages incurred due to lack of service
  - Competitive positioning against other providers
  - Delays to deployments due to changing standards
- **Basic policy is that services must not be affected in a noticeable way due to power saving**
  - Exception #1: Power failure allows service reductions
  - Exception #2: Customer voluntarily turns services off

Technology improvements

- Basic IC technology improvement
  - **Smaller silicon size**
- Better circuit topologies
  - **Burst mode laser drivers**
- Chips that shut down unnecessary functions on the fly
  - **Smart embedded processors, etc.**

User network interface (UNI) power shedding

- Turning off UNI's saves appreciable power
  - **Process described in G.983.2 and G.984.4 recommendations**
- Currently this is supported on many products
  - **Activated during power failures**
  - **Relatively 'risk free' because computers and TVs will be inoperable anyway**
- Difficulty for 'power saving' use is judging when UNI is not active
  - **Computers tend to 'chatter,' even when not in 'use'**
  - **Broadcast TV's have no upstream signaling at all**

UNI and core speed shedding

- Slowing down UNIs and processors that are not being used to capacity
- This could provide some coverage for the difficulty of judging when UNI’s are not used
- It is often difficult to throttle back a UNI or a logical function in a smooth and seamless way
  - **Energy efficient Ethernet is attacking this problem just for Ethernet**
  - **There are many other UNIs that need similar attention!**

Access network interface (ANI) power shedding

- Turning off practically the whole ONU
  - **Reduces power dramatically, but also has big service impacts**
- Minimizing recovery time is key
- “Incoming phone call” problem
  - **Requires rapid periodic reactivation**
- Several approaches to this are under discussion

ANI speed shedding

- Slowing down the PON during low utilization
  - **Making a G-PON turn into a “telephony-only PON”**
- Seems quite complex
  - **Multipoint nature of PON makes it unlikely that all ONUs will be slack at the same time**
  - **Not clear if this saves a tremendous amount of power**

Scheduled shutdown

- Simply turn down ONU when you can
  - **Could be based on time of day**
  - **Could be controlled (overridden) by customer**
- Not really a technology issue, more implementation issue
  - **For example, most FTTH ONTs in US have no way to ‘turn off’, even if the user wants to do so**
- Some small issues regarding handling of alarms, etc.

Overcoming the lifeline problem

- Imagine an ONU with an embedded cell phone
  - **Lifeline connectivity is maintained**
  - **In addition, a low level of back-up in case of fiber cut is provided**
- Cost could be a major factor
- Wireless – wireline telephony mobility must be supported
  - **Not only to complete the wireline call via the wireless facility…**
  - **But also to trigger the wake-up of the ONU**

Larger view of FTTH and power consumption

- The energy consumed by the access network is a small portion of the total “communications footprint” inside the typical home
  - **Large monitors, Set-top boxes, computers, home networking all consume far more power, and some are ‘always on’…**
- Power saving should be coordinated at a system level
  - **Larger pool of potential savings is available**
  - **Fewer user noticeable service impacts**
- Providing true broadband* can result in ‘green lifestyle’
  - **If 1 out of 30 homes adopts teleworking due to FTTH, and therefore drives their car half as much, FTTH can be ‘carbon neutral’**

*** Broadband that reliably exceeds 100Mb/s symmetrical capacity**

Conclusions

- Power consumption in OAN is a growing issue
- Operators and Vendors are cautious, and do not want to disturb the growth of FTTH at this early stage
- Many concepts, issues, and solutions are in play

Future Plan

- Adding power consumption as an integral part of the optical access question and plan
- Apply the energy-saving checklists to all new efforts
- Will continue with surveys of operators, administrations, and vendors to gather information
- Look to incorporate power saving features into both existing (G-PON) and new (NG-PON) systems
  - **In accordance with industry and regulatory norms**
  - **When economically and commercially viable**