

# Requirements from an operator perspective

IEEE 802.3 Higher Speed Study Group interim session in Geneva

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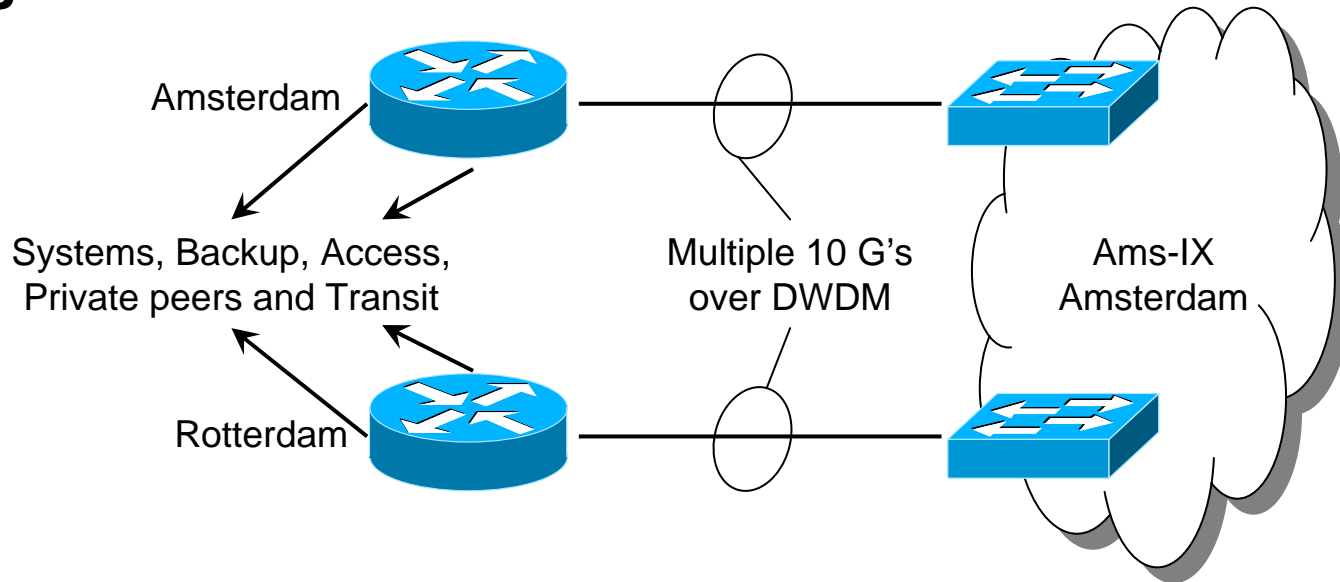
# Overview

- Introduction
- Configuration
- Usage and historical growth
- Growth predictions
- From Traffic volumes to interface-speeds
- Conclusions from the operator perspective

# Introduction

- Ad Bresser, Chair Innovation Office
  - Innovation Push, e.g. Fixed – Mobile, Second Life and Optimizing video distribution over Internet
- KPN: Incumbent Operator in the Netherlands
- Local Broadband market:
  - Five million Broadband connections.
  - 70% of households on Broadband Internet
  - KPN Market share: 40%
- Competition is very much on Access speed
- Presentation scope: Traffic between our ISP infrastructure and the Ams-IX.
  - Systems, Backup, Access, Transit and Private peering traffic volumes are out of scope.

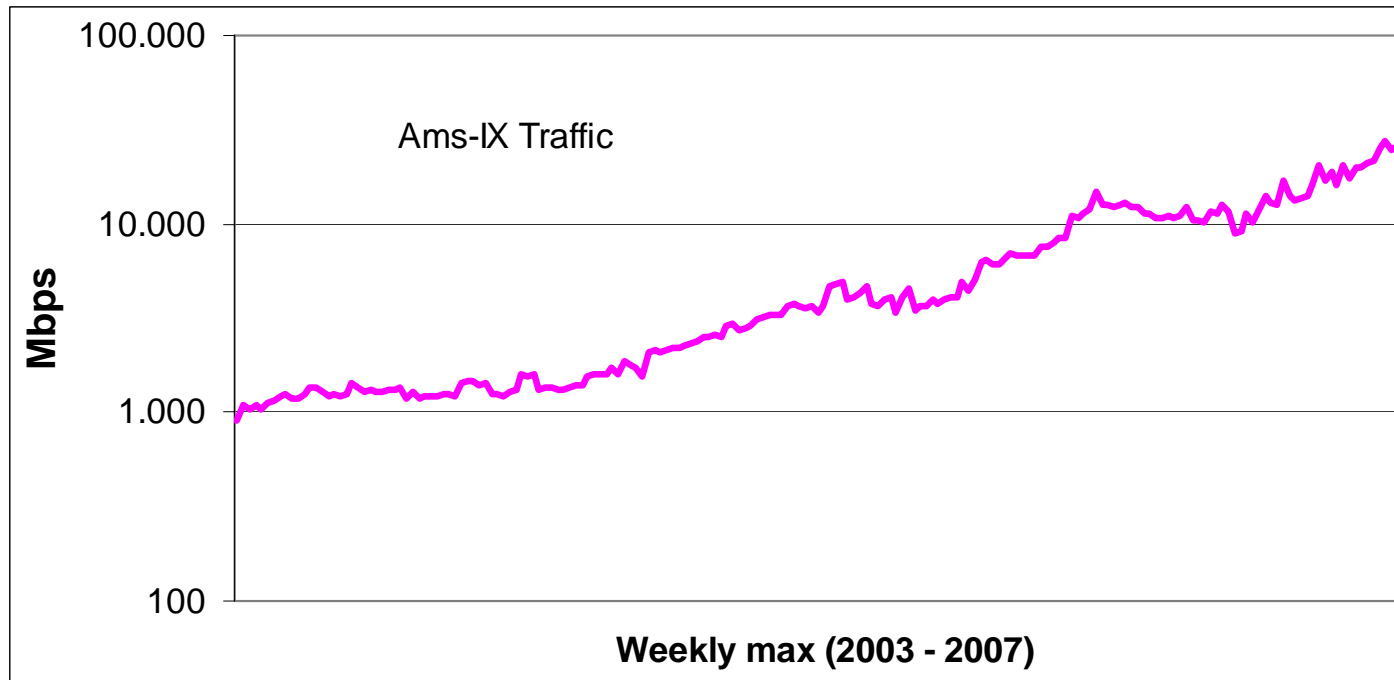
# Configuration



- Router – Switch connections
- Over multiple 10 Gbps DWDM channels (bundling)
- Design rule: max link utilization is 50%
- >200 peers are connected over the Ams-IX infrastructure
- External connection towards an Ethernet based Internet Exchange with 250 members

⇒ Standardization is the only way

# Usage and historical growth

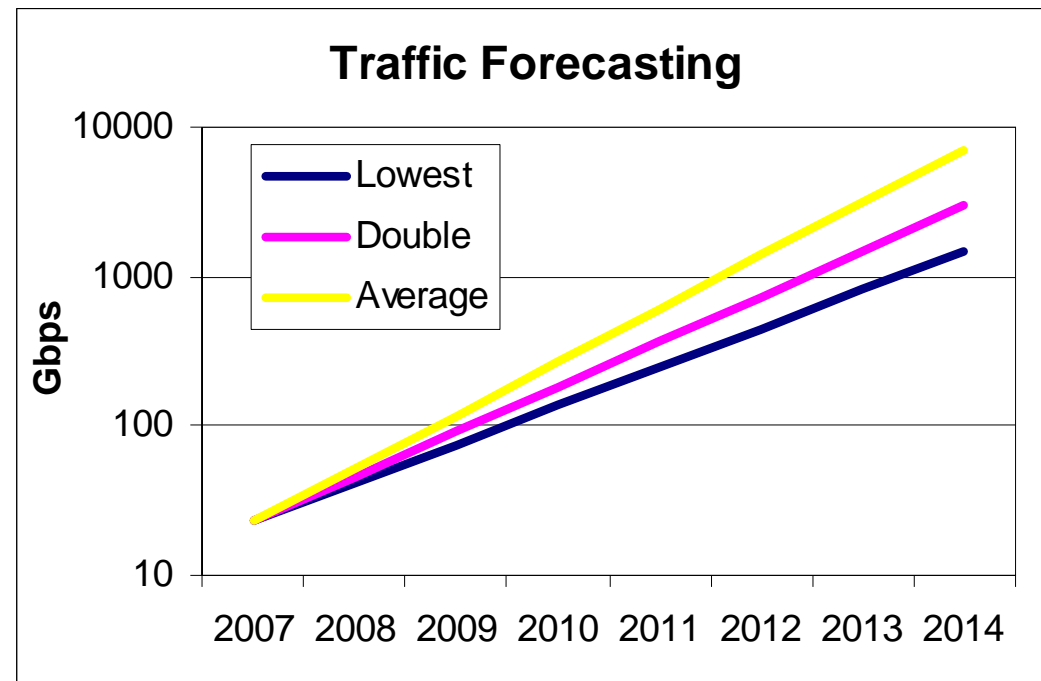


- Annual growth varies a lot
- During autumn and winter a steady growth
- Stable / slight decrease in summer
- Total traffic with Ams-IX in april: 23 Gbps

Beginnig	M6 (%)
2003	39%
2004	162%
2005	228%
2006	81%
2007	
Average	127%

## Growth predictions

- Our growth will be lower than the past few years, mainly due to high broadband penetration reached
- Three scenario's:
  - Continue **lowest** annual growth
  - **Double** every year
  - **Average** annual growth of the last four years
- 2009: 100 Gbps reached
- 2012 – 2013: 1 Tbps reached



# From Traffic volumes to interface-speeds

- Bundling history towards Ams-IX:
    - 100 Mbps: non
    - 1 Gbps: two bundels of  $2 * 1$  Gbps each
    - 10 Gbps: 23 Gbps => two bundels of  $3 * 10$  Gbps (so far)
- ⇒ Interface-speed development doesn't keep up with the growth of the Internet traffic.
- The current maximum of bundling is  $8 * 10$  Gbps and  $16 * 10$  Gbps is underway.
  - Bundling above 8 is not practical, it will slowly reduce the router to an interface converter.
  - Bundles of 8 means that we will need 100 Gbps ye 2008 / beginning 2009

## Conclusions from the operator perspective

- These insights are based from the perspective of an operator in a small country, with a relatively high broadband penetration.
  - ⇒ Expect similar issues in larger countries.
- Interface-speed development doesn't keep up with Internet traffic growth
- 40 Gbps would be a good standard to have right now, but 100 Gbps is needed before 2009.
- Before 2012 a standard describing 1 Tbps should be available
- Standardization should include High Speed over DWDM