

# Implications of the topological traffic properties of Internet traffic on traffic engineering



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# Agenda

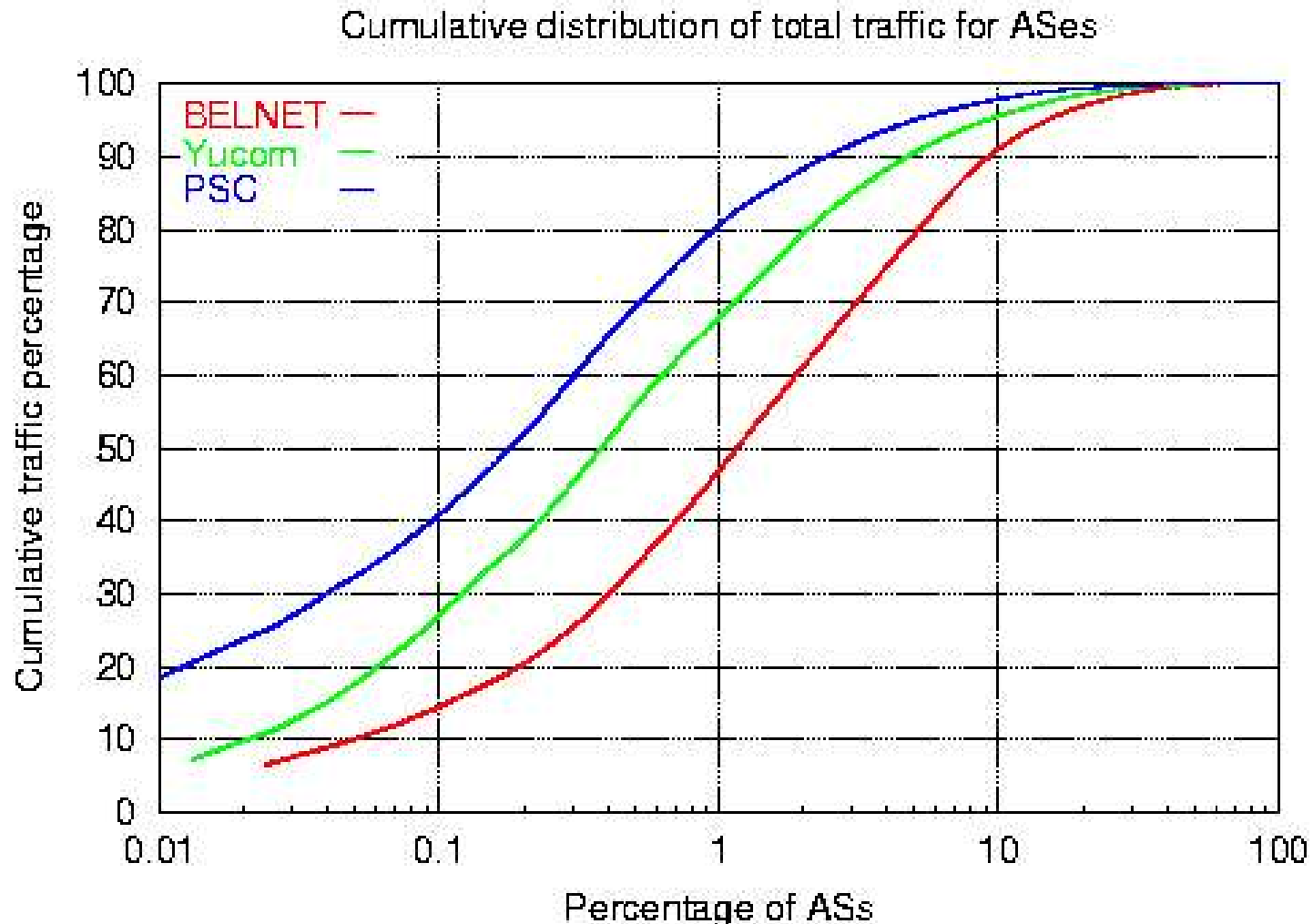
- **The Interdomain Internet**
- **Topological traffic distribution**
- **Topological traffic dynamics**
- **Implications on traffic engineering**
- **Conclusions**

# The Interdomain Internet Today

- **About 16,500 Autonomous Systems**
- **Hierarchical structure :**
  - **Dense core : 20 large transit ISPs (worldwide)**
  - **Outer core : smaller transit ISPs (regional)**
  - **Edge : stubs**
- **86 % stubs ASes / 14 % transit ASes**

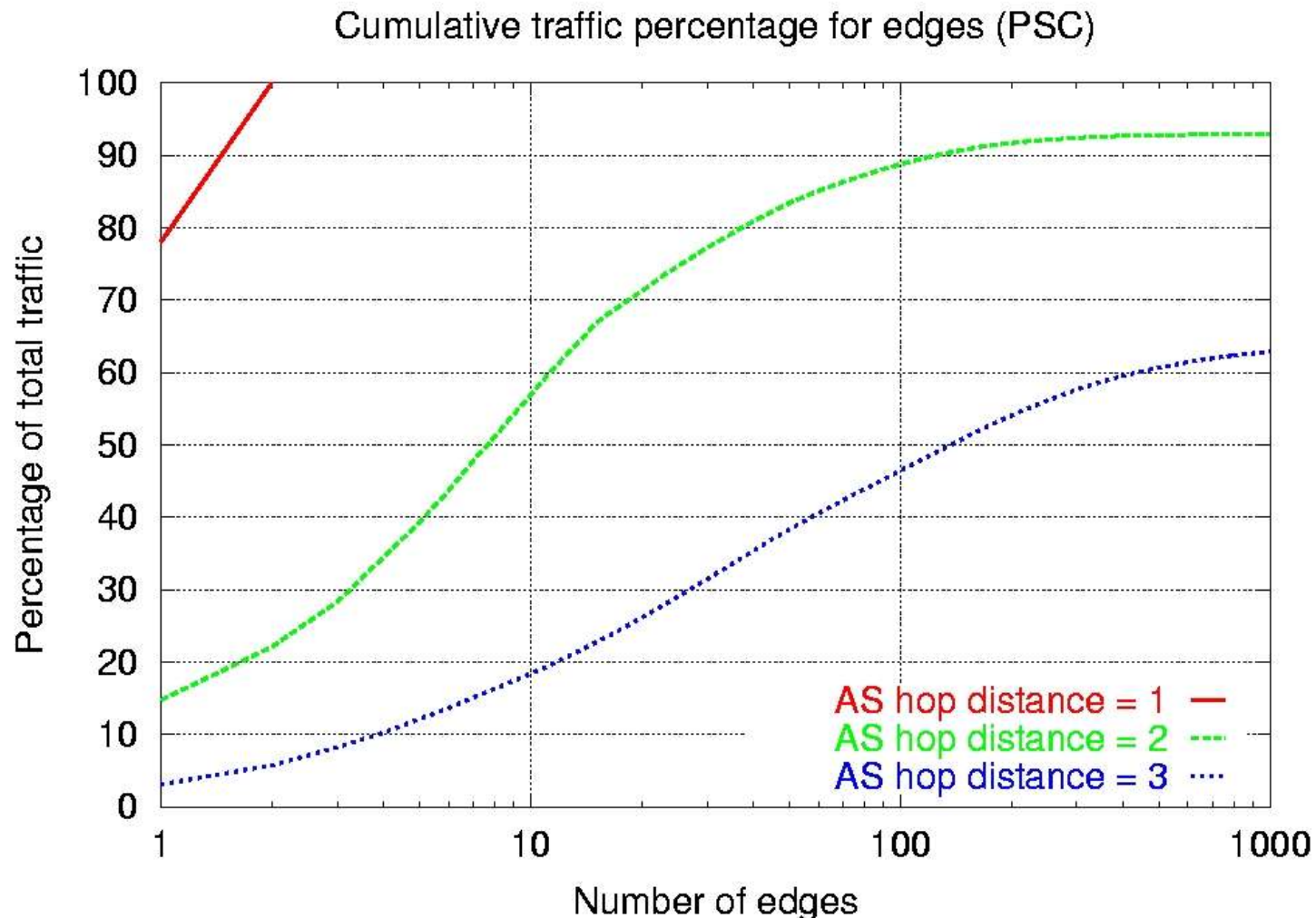
# Topological traffic distribution

## Traffic captured by largest destination ASes :



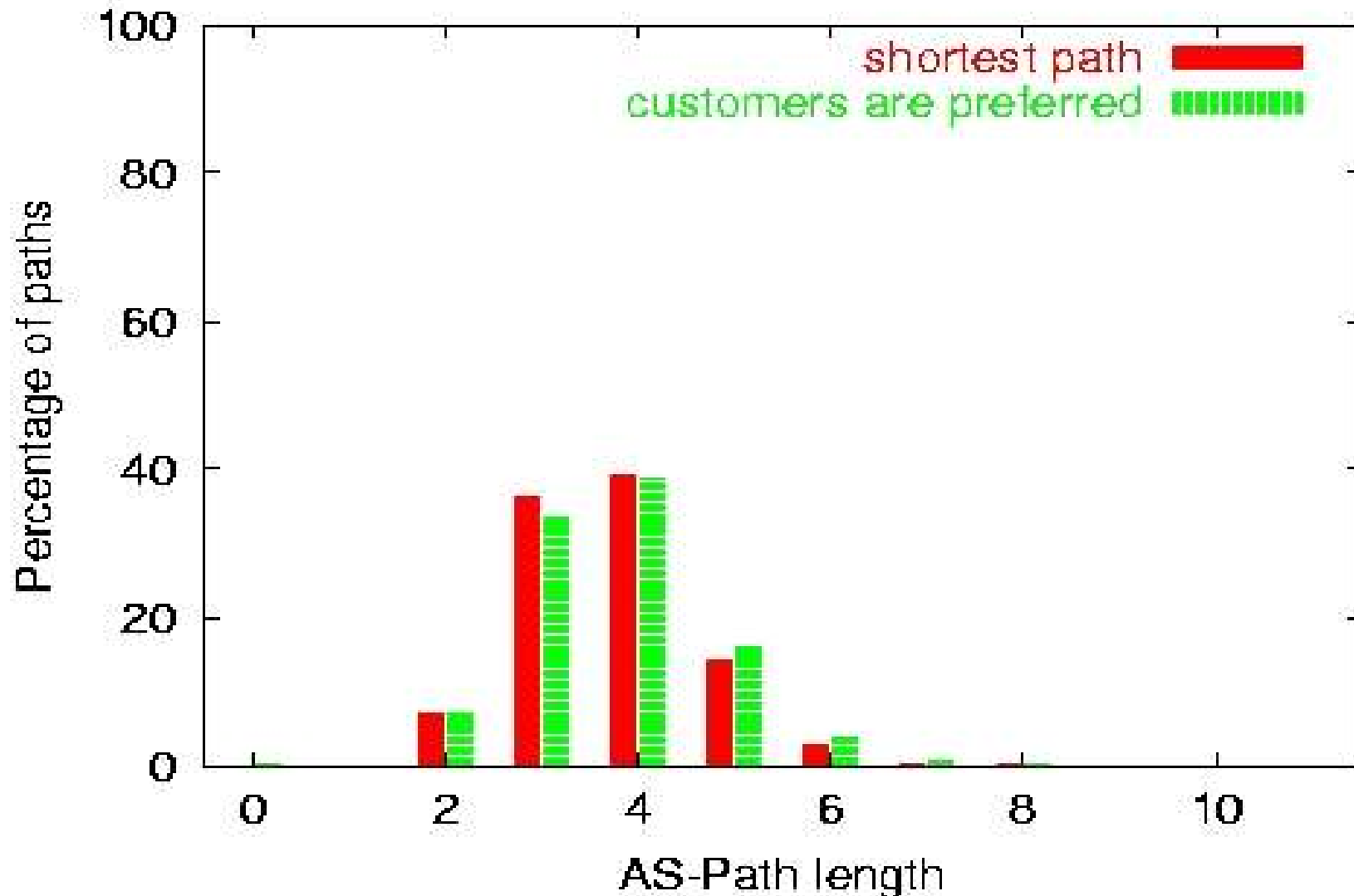
# Topological traffic distribution

Traffic aggregation seen by a typical stub as :



# Topological traffic distribution

The interdomain Internet is shallow :



# Topological traffic distribution

- **A limited percentage of the interdomain topology sends/receives most of the traffic.**
- **Most of the traffic exchanged with ASes located within a few AS hops.**
- **Lack of traffic aggregation beyond peers.**
- **Topological traffic distribution is a consequence of hierarchical structure of the interdomain topology.**

# Topological traffic dynamics

## Motivation :

- **Topological traffic distribution suggests that**
  - **caring about a very limited fraction of the interdomain topology is enough for traffic control purposes**
  - **“small” timescales see the same topological distribution as large timescales**
- **Is that true ?**



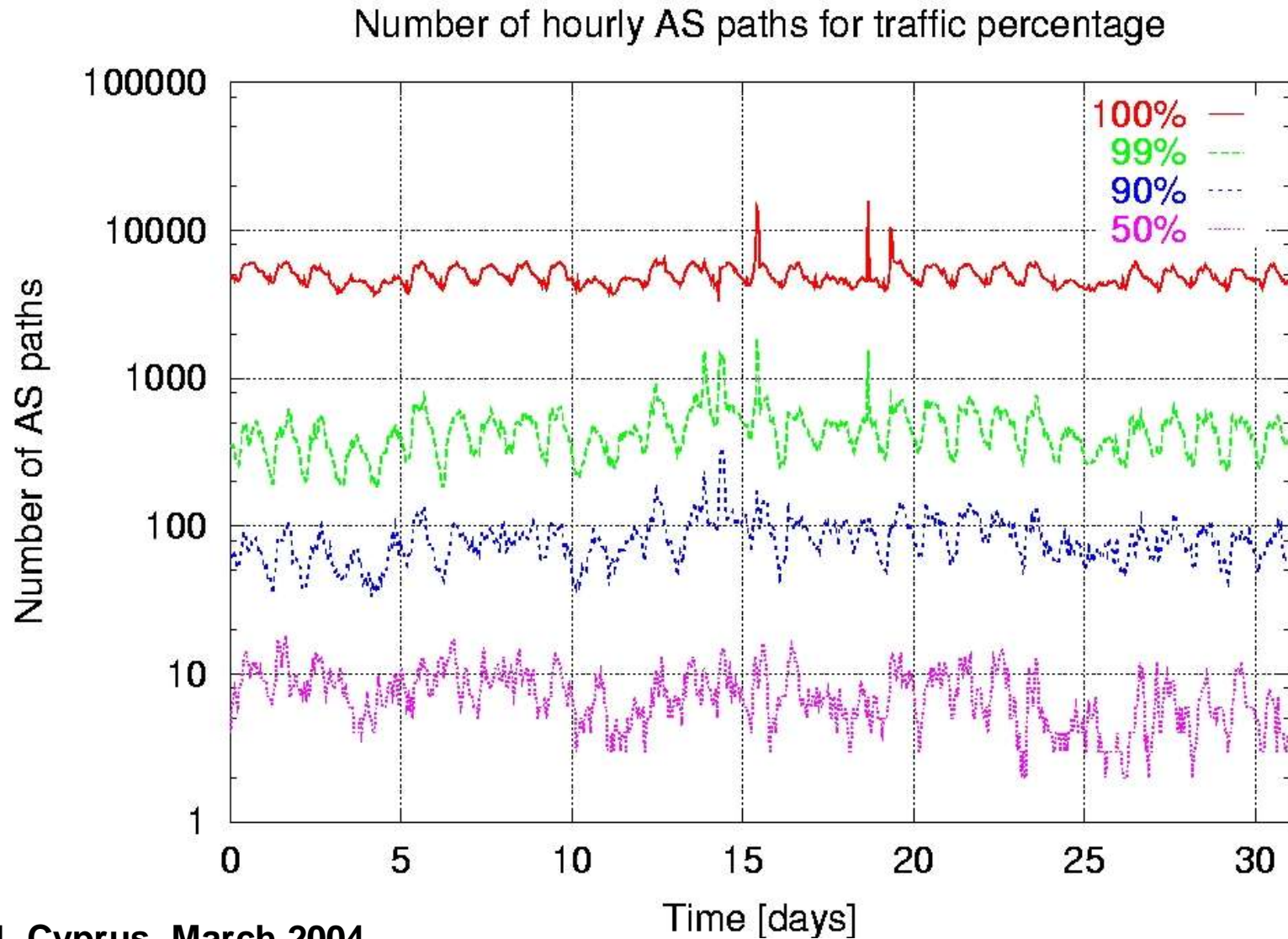
# Topological traffic dynamics

## Stability of interdomain paths :



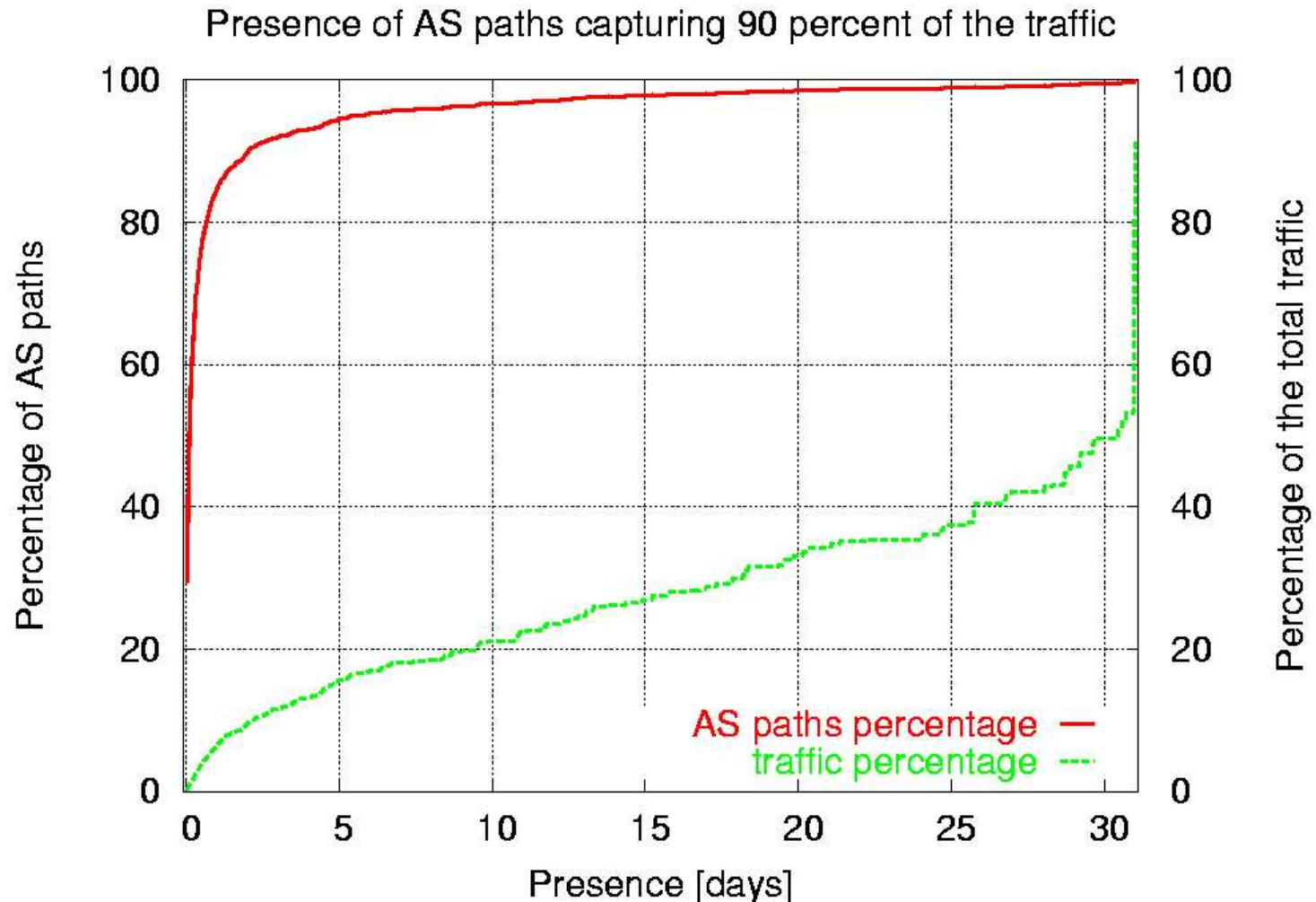
# Topological traffic dynamics

## Number of largest hourly traffic destinations :



# Topological traffic dynamics

How stable are the largest traffic destinations ?



# Implications on traffic engineering

***“A few interdomain sources generate most of the traffic”*** is misleading :

- still a large number of interdomain sources (100's) on a hourly timescale
- non-negligible fraction of interdomain traffic for “unstable” sources
- predicting the important traffic sources for next hour is an issue

# Conclusions

- **Interdomain paths seen by most of the traffic are stable.**
- **Part of the interdomain traffic sources/destinations are “stable”, part are “unstable”, and remaining in-between.**
- **Traffic control may need to influence a larger fraction of interdomain topology than previously thought due to this variability.**