Netnod Internet Exchange

SIG-IX presentation
APRICOT 2005

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History

- Netnod was formed from then D-GIX at KTH-NOC in 1996 / 1997
- Reason for creating Netnod was to create an independent and resilient exchange infrastructure
- Early on focus was on redundant systems
  - Also from a national infrastructure point-of-view

History

- At the time of creation
  - Government report that cited Internet as critical national infrastructure
  - That some of that infrastructure was more important than other
- Design of Netnod was influenced by the view on national security

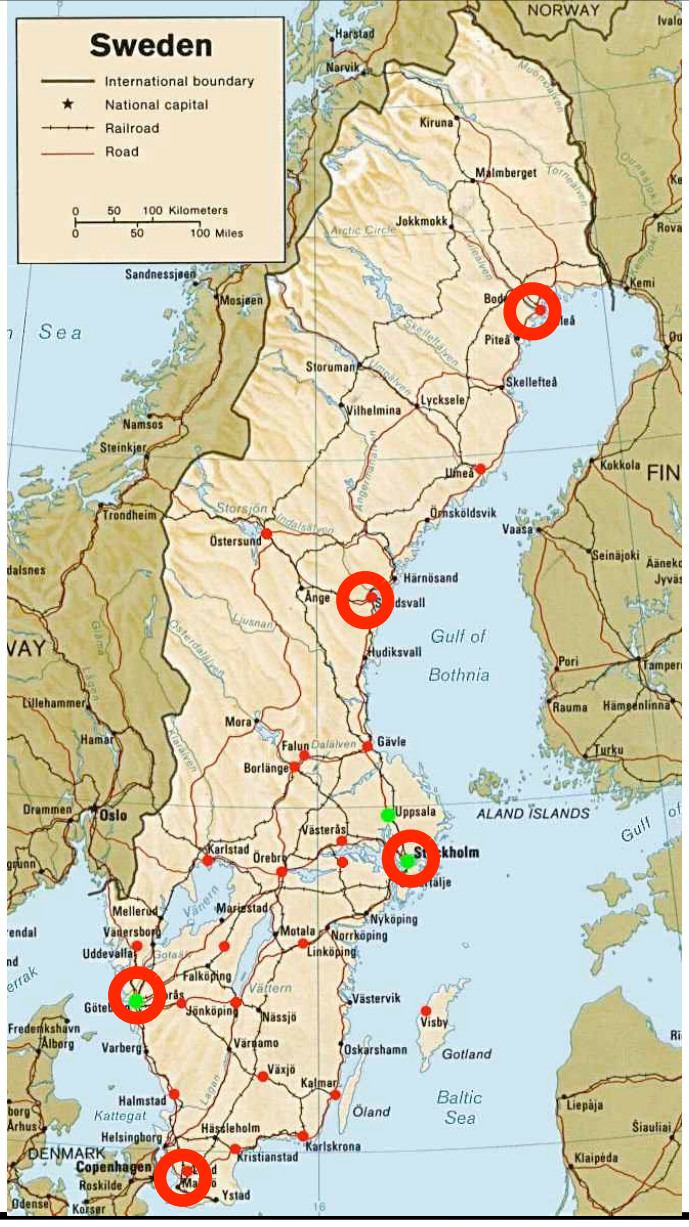
Physical separation / redundancy

- Early on it was decided that the exchange of traffic had to work even in times of national crisis
  - Stockholm would not be a focus point
  - Any backup site had to survive on it’s own
- Search for suitable locations started
  - And turned out to be a fairly complex process

Locating sites

Criteria that had to be met

- Population / Traffic volume
- "Carrier capacity"
  - It had to be fairly easy to get to
  - Preferably most where already present
  - Was probably the hardest criteria to meet….
- Somewhat spread across the country
- Existing Mountain cave…



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Other effects of the diversity

- Early on local exchange of traffic was seen as a possible “Good thing™”
  - However turned out to be somewhat harder than first though
  - Until around 1999 traffic was still sent through Stockholm even for ISPs connected to Gothenburg
- This slowly changed
- Today a lot of traffic is exchanged locally
  - Gives overall better performance

The Caves

- For the establishment of Netnod, it was decided it would be better to migrate away from KTHNOC to “neutral” ground
- Earlier the regulator had constructed a number of mountain caves around the country to house critical PSTN infrastructure
- Netnod, building on the earlier government report, asked to get the same status and housing agreements

The caves

- The following is a very general description….
- The caves are built to withstand a “direct hit”
  - For some definition of direct
  - For some definition of hit
- Each cave have an access road down to a larger “room”
- Each room houses a number of “buildings

The Caves

- Each building is protected against EMP
- Each cave have at least two fibre access paths
- Dual power and cooling built in the mountain
  - We in addition have dual 48V and AC UPS and battery infrastructure

The caves

- Netnod rents a room with access control inside each of the buildings
- Only Netnod staff have access to the rooms
  - Entries into the rooms are reviewed every month
- The caves are operated by various entities
  - Some by the military, some by others
  - Netnod hands-on used to be done by the military as well

Access to the caves

- In Stockholm the charges for connecting to Netnod includes the cost for two separately routed fiber pairs.
  - One to each cave
- In the other cities, the ISP have to find a fiber provider themselves
  - Co-ordination needed to patch through to us

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Critical infrastructure

- It was decided that is was of importance to locate some of the critical common Internet infrastructure at the Exchange points as well
- Netnod have tried to develop the amount of services available at the exchanges

Common Services

- Official Swedish time through NTP
  - In Malmö, Sundsvall, Gothenburg and one cave in Stockholm
- i.root-servers.net
  - Location in Sweden not disclosed
  - Can also be run from all caves
- .SE TLD-service
  - Stockholm, Gothenburg, Sundsvall
- A number of TLDs in Stockholm
  - Among others Verisign's .com and .net
  - .DK, .NL, .DE, .NO etc.
- Copy or RIPE routing registry in Stockholm

Service resilience

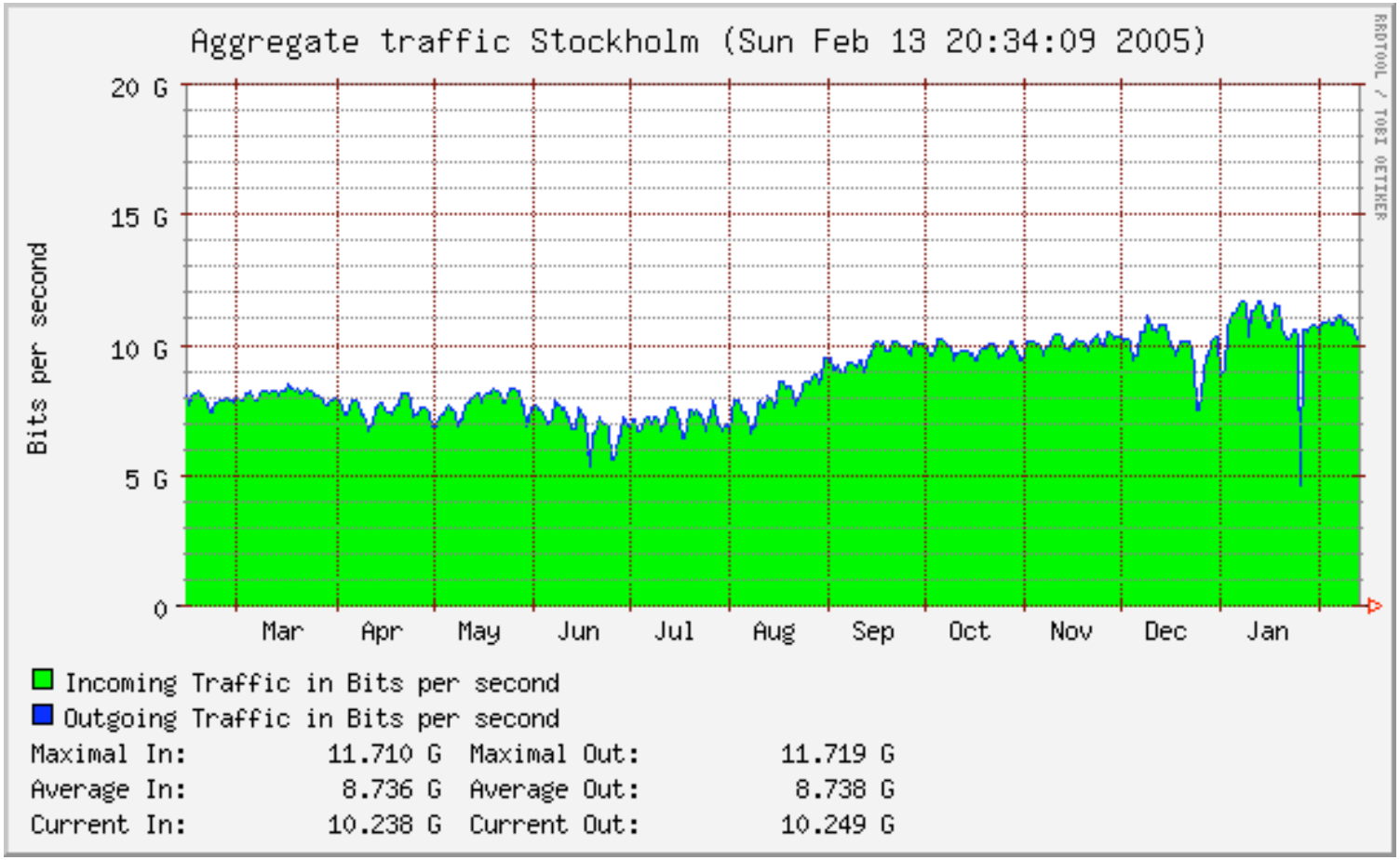
- Most services distributed
- For i.root-servers.net we are deploying anycast
  - Today in Sweden, Helsinki, Oslo, London, Amsterdam, Frankfurt, Brussels, Geneva, Milan, Bucharest, Ankara, Washington D.C, Chicago, San Francisco, Hong Kong, Bangkok, Kuala Lumpur, Jakarta, Tokyo

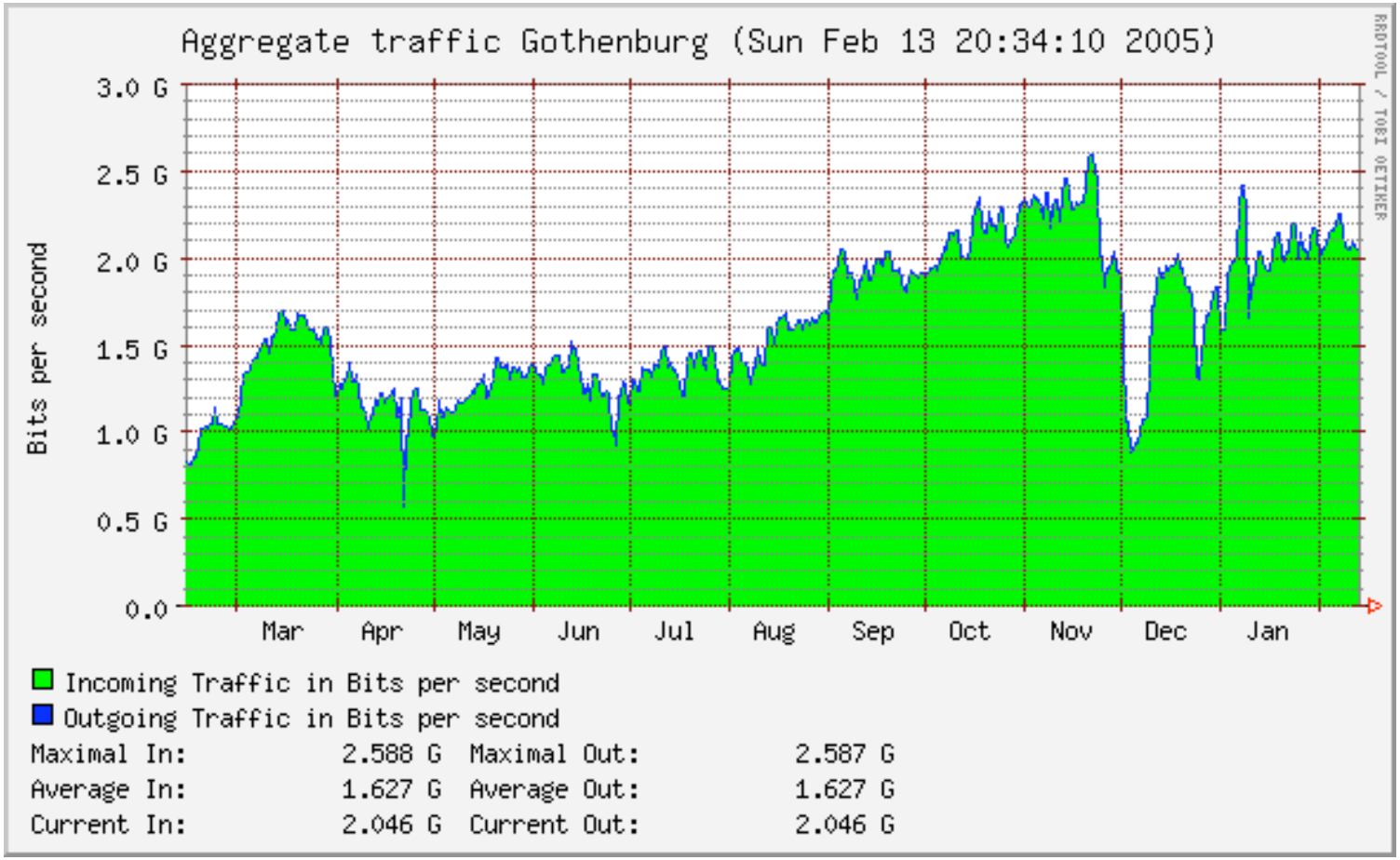
Future services

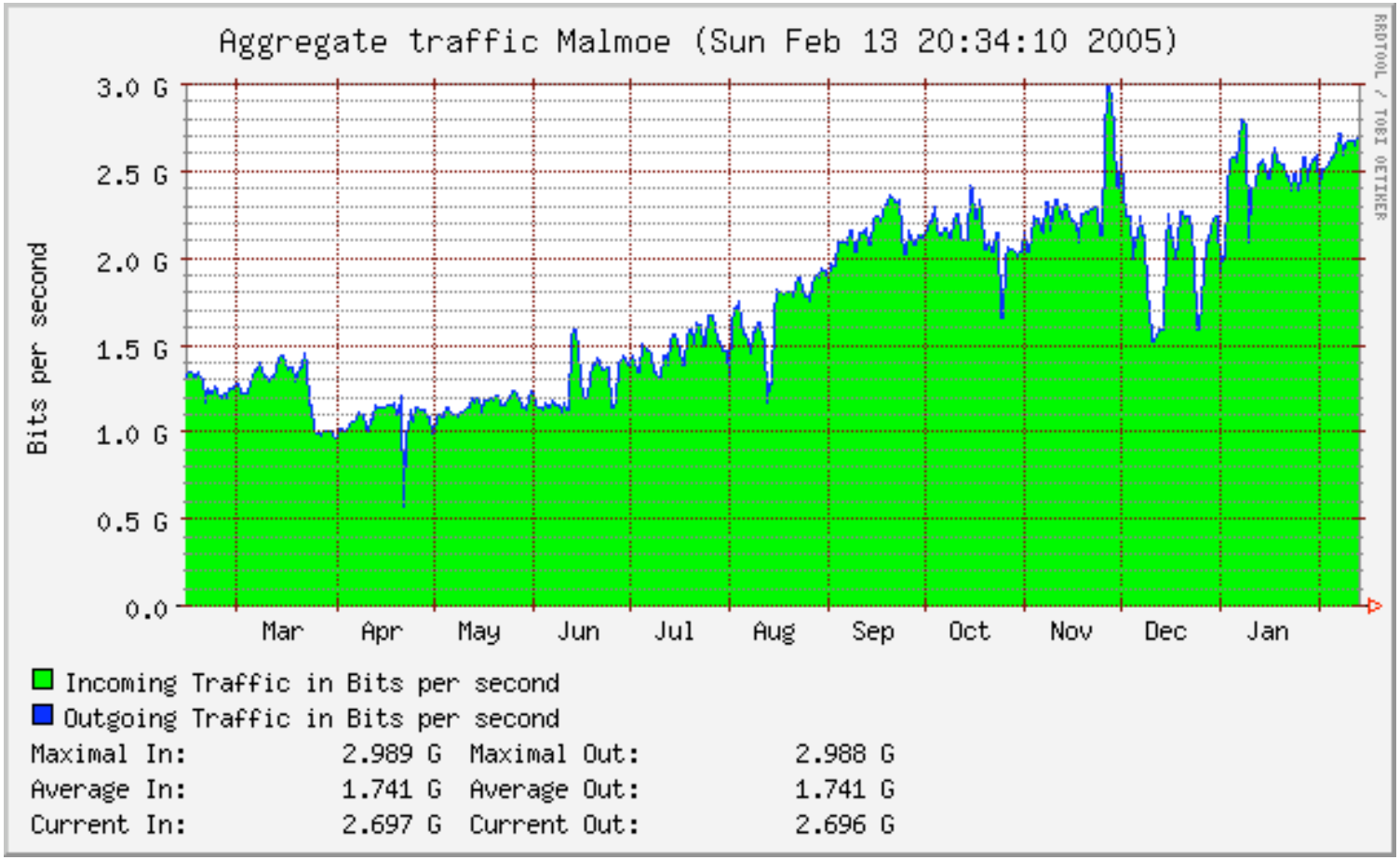
- We are working on a SDH/SONET synchronisation service based on the atomic clocks we have
  - G.811 compliant

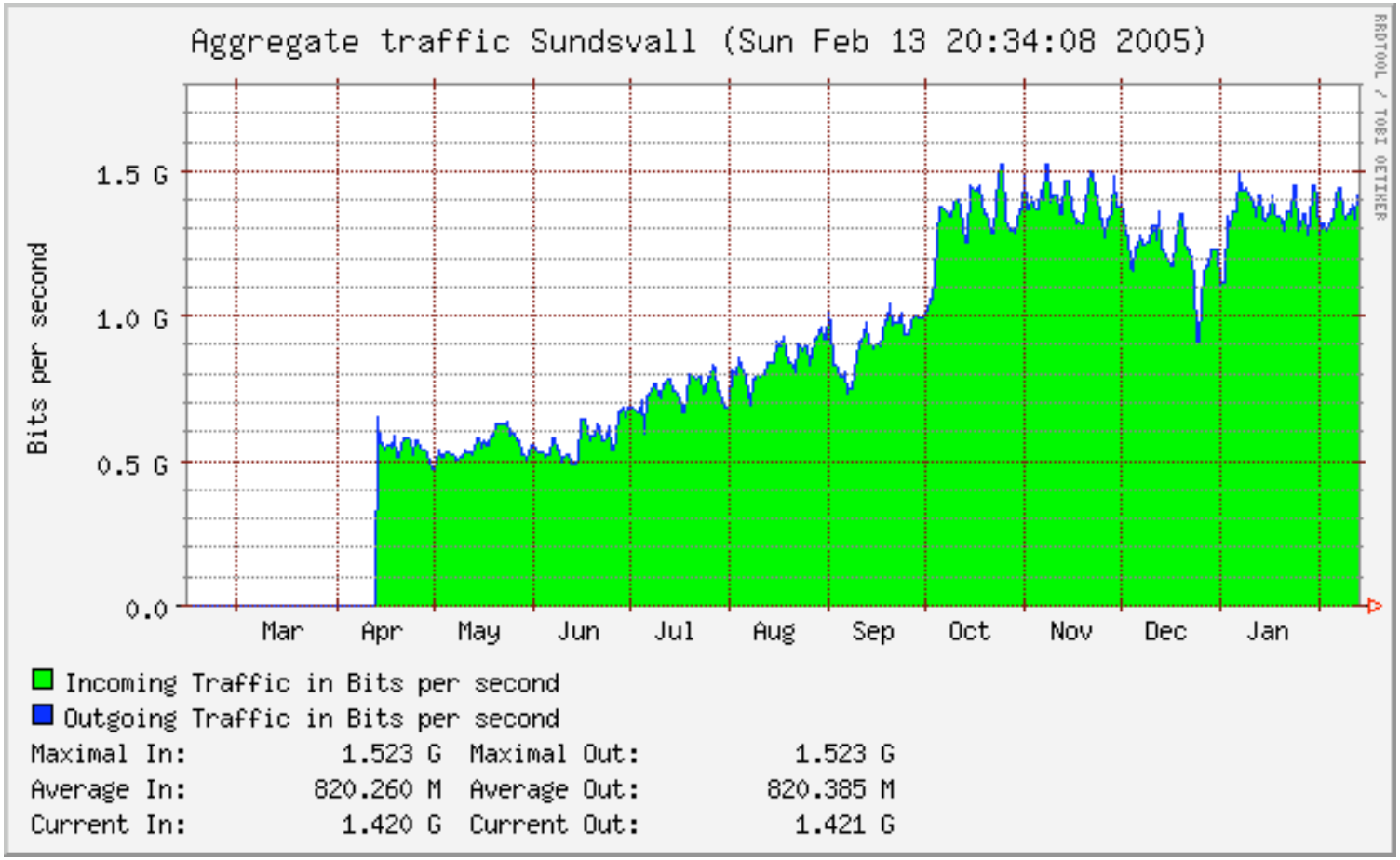
Connected customers

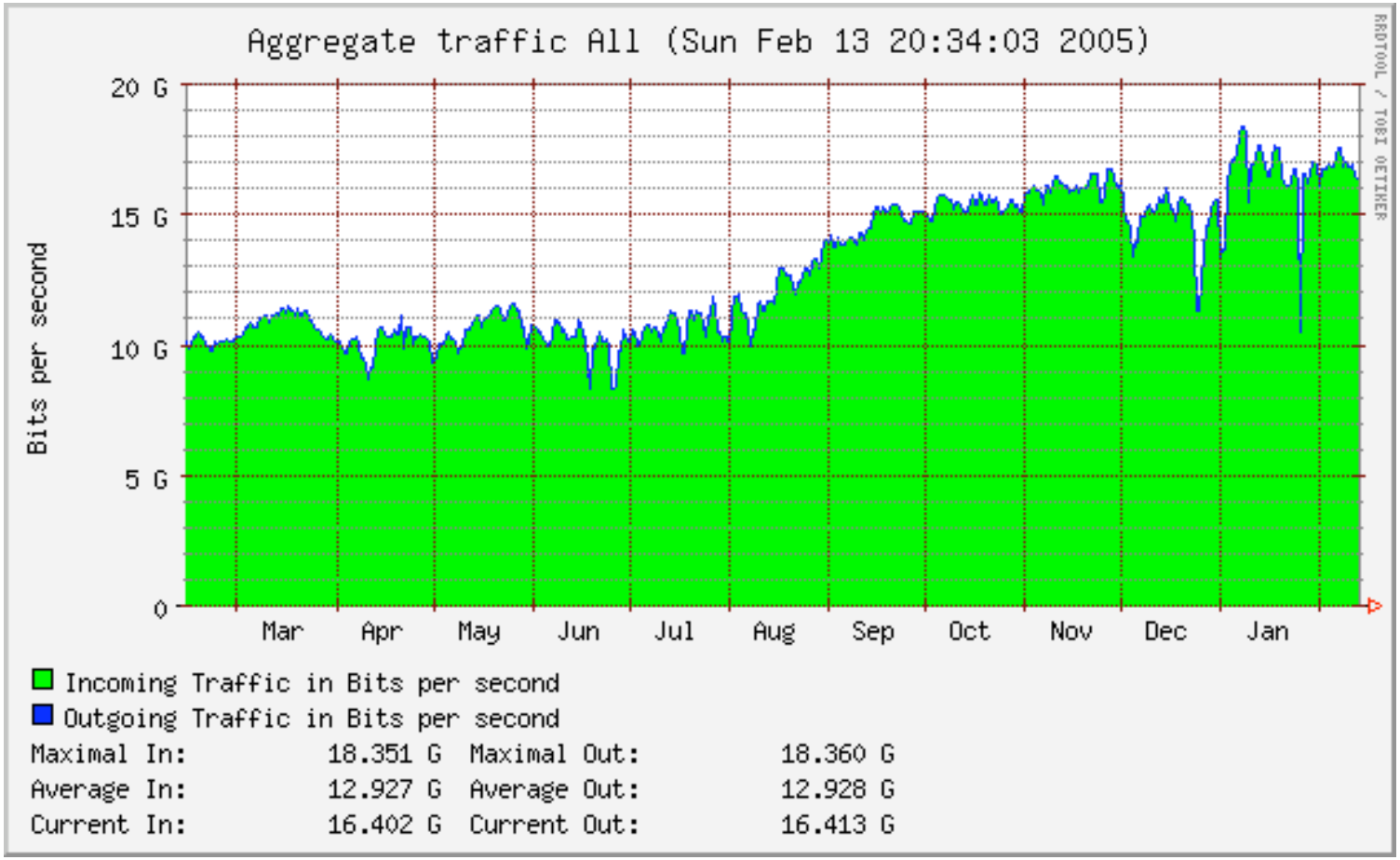
City	Customers
Stockholm	36
Gothenburg	10
Malmö	12
Sundsvall	8
Luleå	3

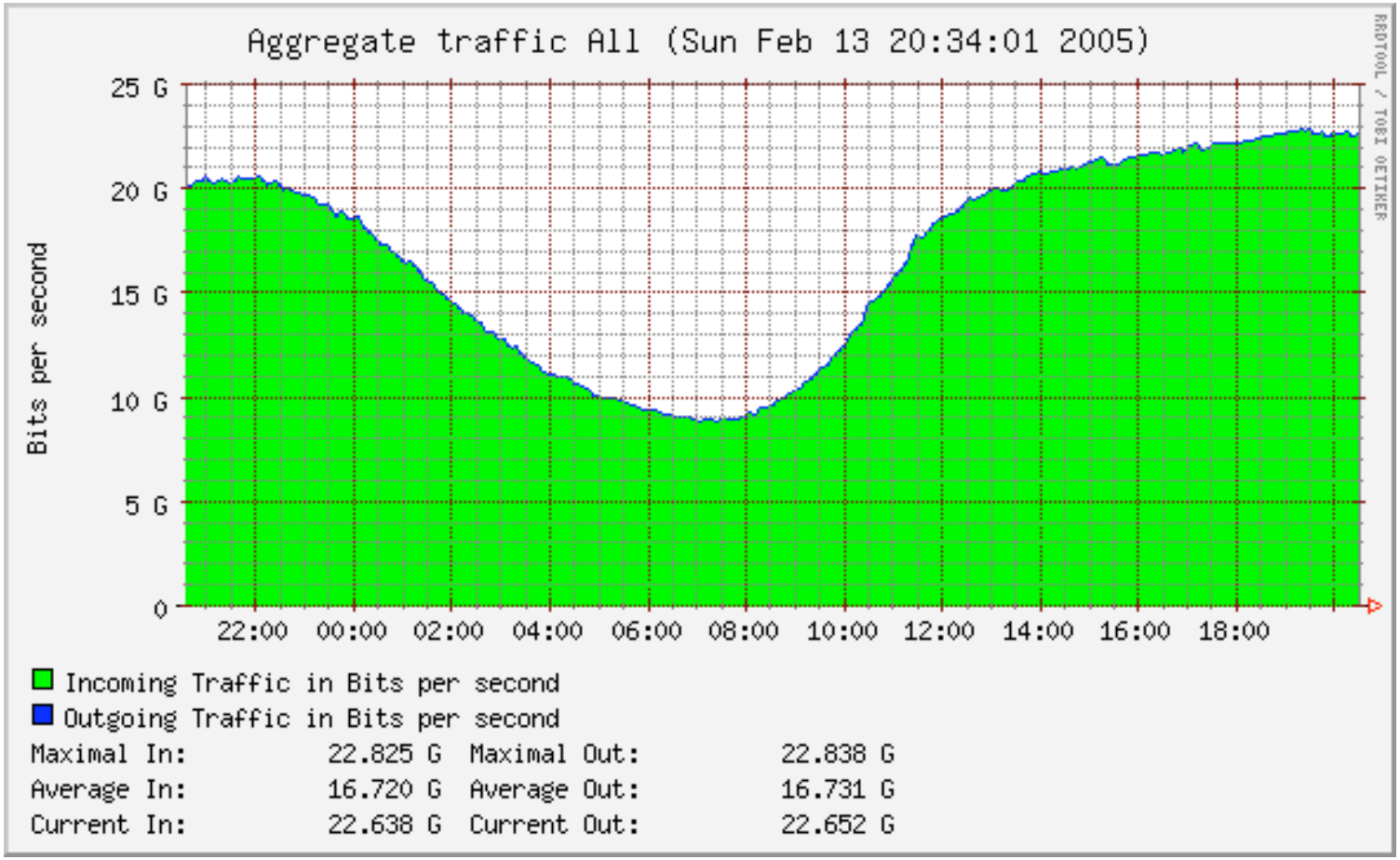












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