Analyzing the Impact of Major Social Events on Internet eXchange Traffic

October 10, 2006

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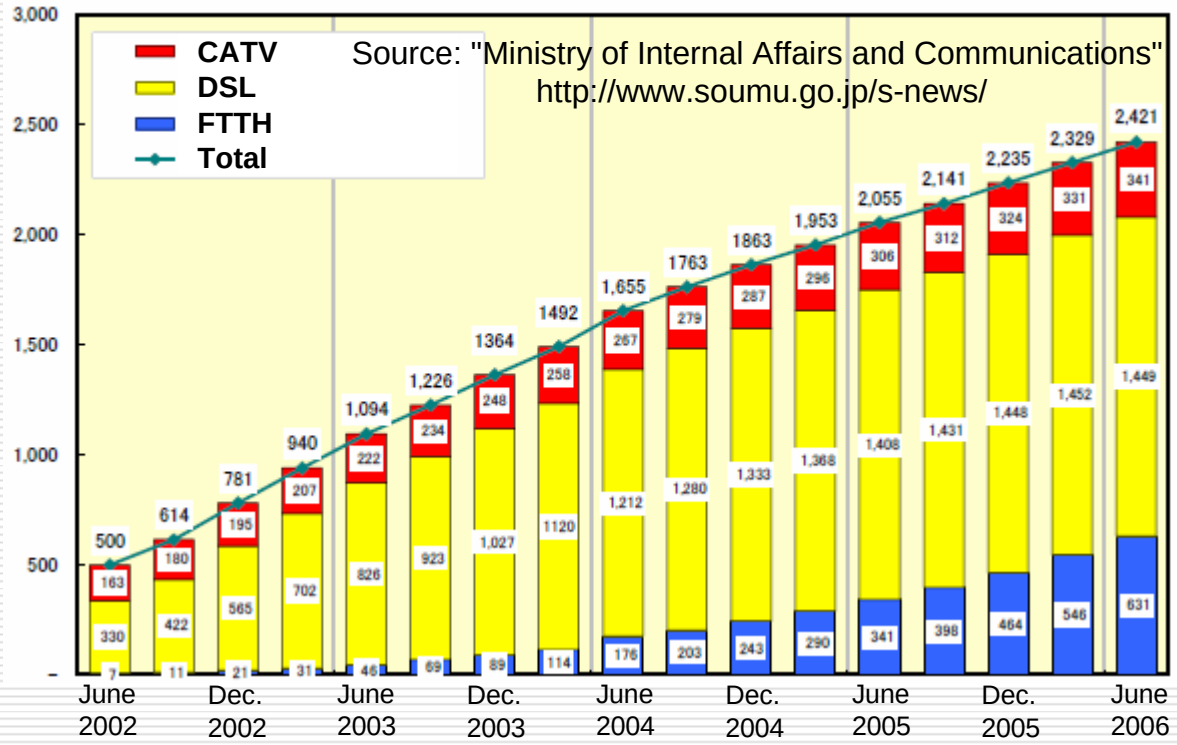
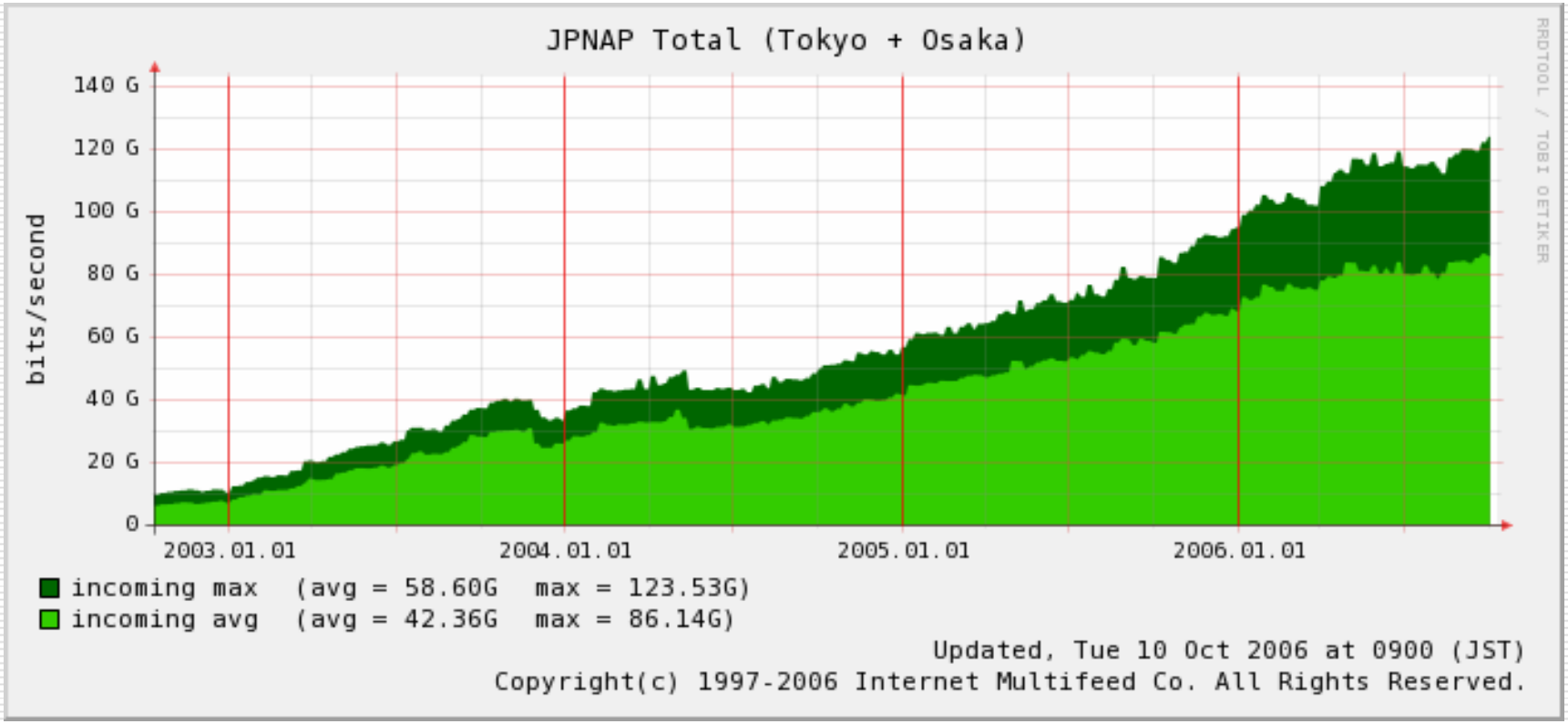
1. Background (1)

- 24 million broadband subscribers in Japan (as of June 2006)
  - DSL (1Mbps~50M) ... 14 million (slowing down)
  - CATV (~30M) ... 3 million
  - FTTH (100M~1G) ... 6 million (increasing exponentially)



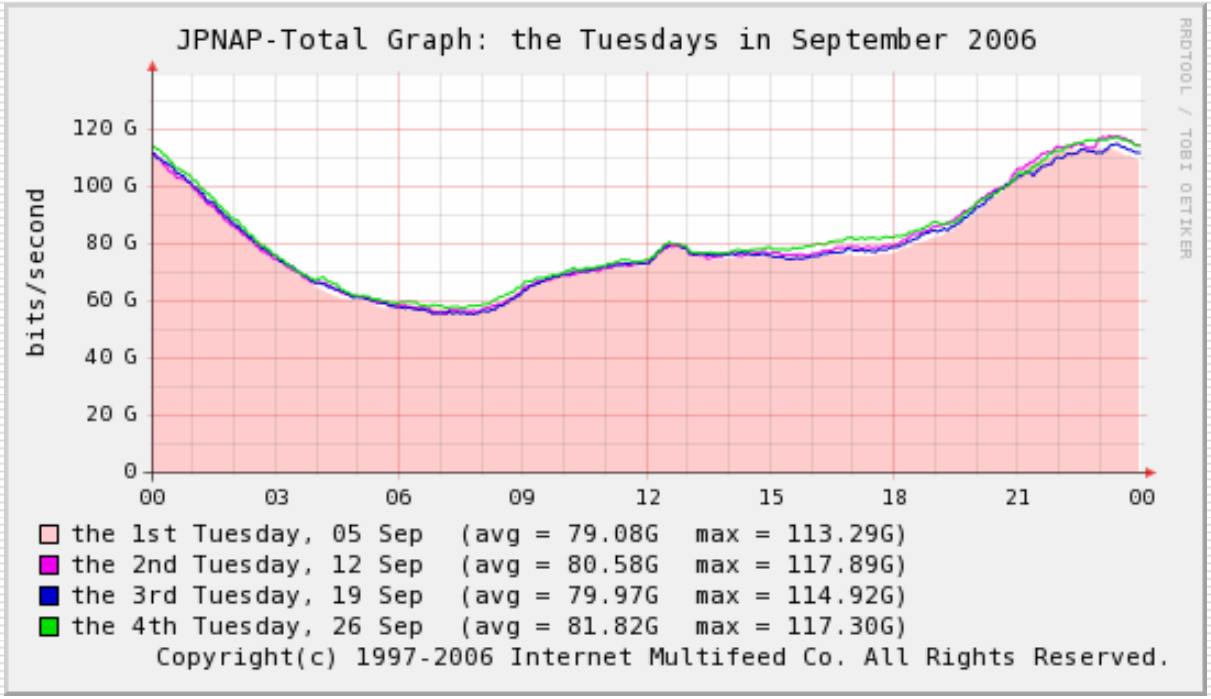
1. Background (2)

- JPNAP
  - Ethernet-based Layer-2 IX in Japan
  - Aggregated traffic reaches 120 Gbps.
    - Increase of 50% in the past 12 months



2. Analyzing aggregated traffic on the JPNAP (1)

- Daily traffic cycle
  - E.g. Tuesdays show us almost the same trend.
    - Except national holidays, and vacation seasons



  - We can use this characteristic in our operation to
    - Decide maintenance windows
    - Apply threshold monitoring, ...

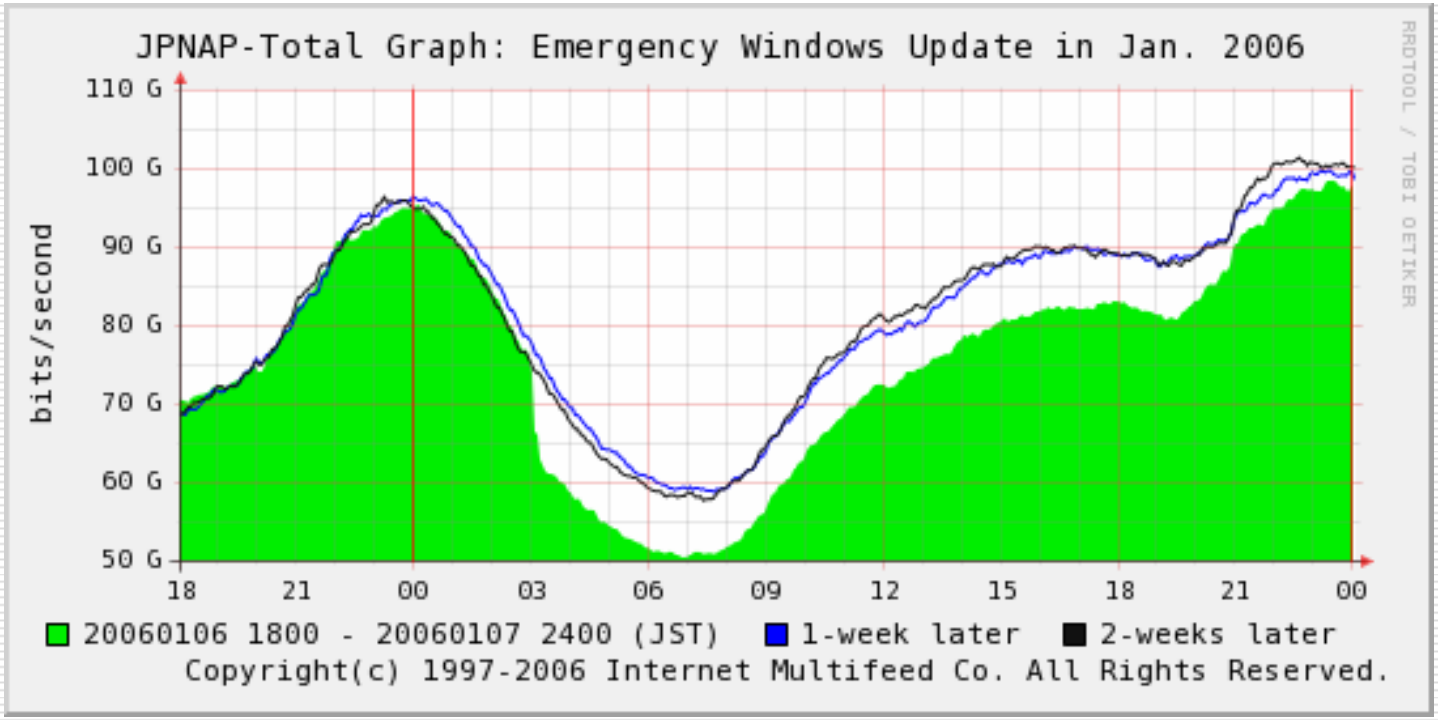
2. Analyzing aggregated traffic on the JPNAP (2)

- Sometimes traffic “anomalies” are detected.
  - Temporary fluctuation (+20% ~ -20%) of total traffic
  - Excludes subscriber issues or network outages ...

- Types of events causing traffic anomalies on the JPNAP this year
  - Microsoft/Windows Updates
    - Emergency release
    - Monthly, regular release
  - Social Events
    - Major sporting events

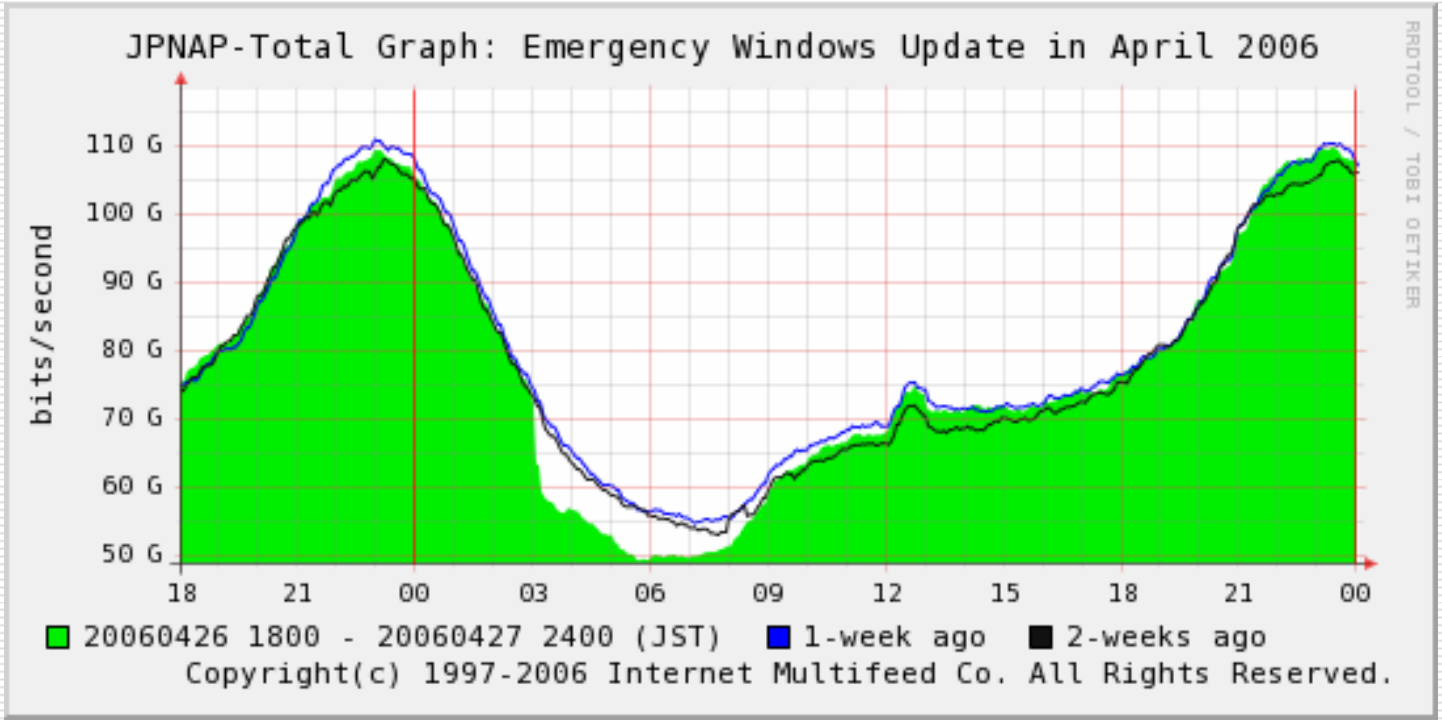
3-A. Windows Update (January 7, 2006, 3:00am JST)

- Microsoft released an emergency Windows Update on that day.
- Maximum 18% Down (compared with 1 week and 2 weeks later)
  - 18 hours to recover to the normal level



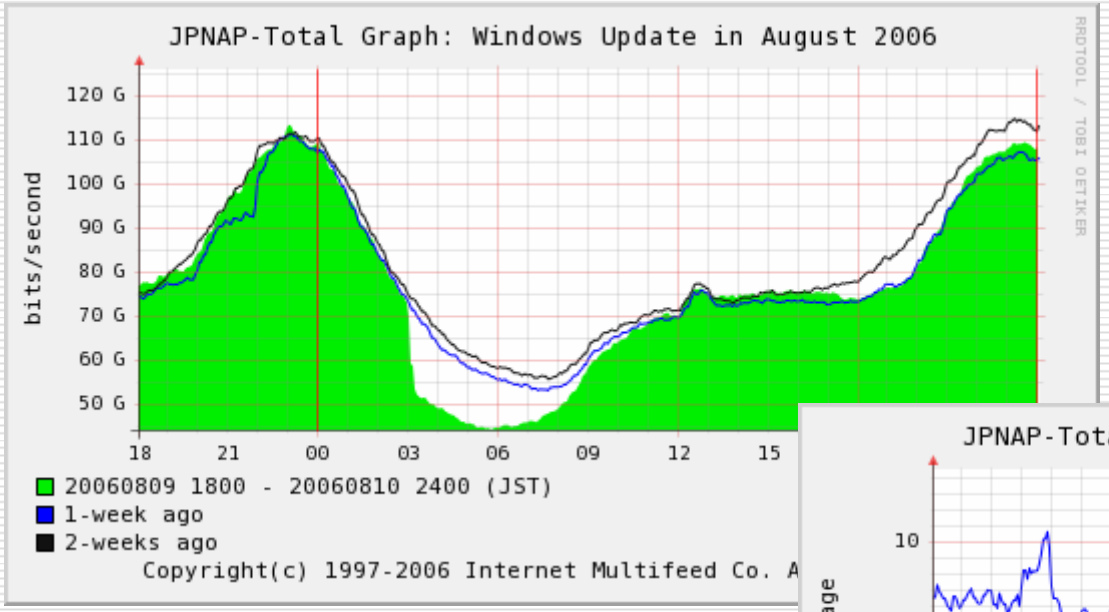
3-B. Windows Update (April 27, 2006, 3:00am JST)

- Emergency Windows Update again.
- Maximum 17% Down
  - Recovered in 6 hours (less impact than Jan.7)
    - Differences between Weekend and Weekday

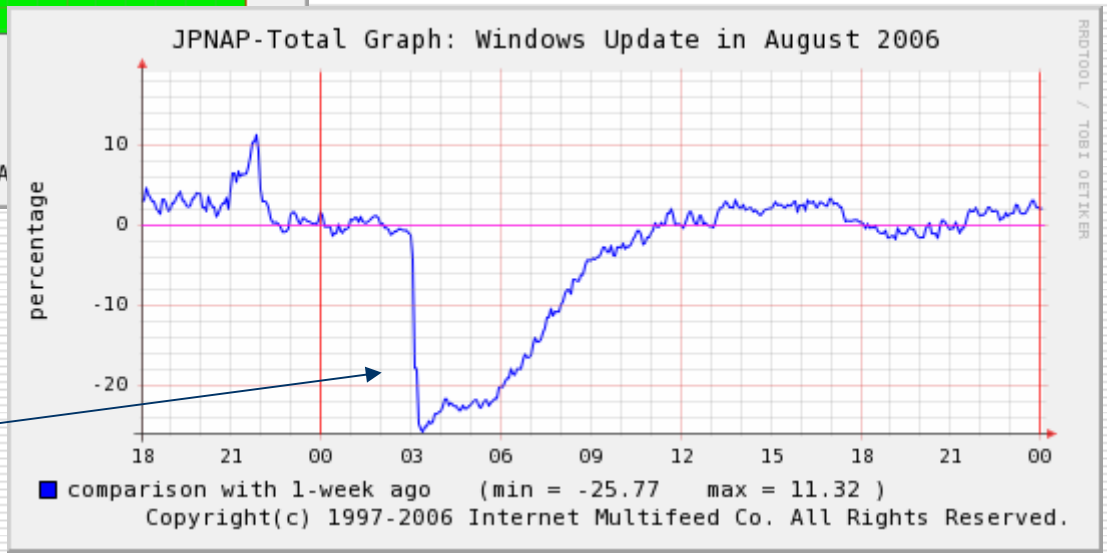


3-C. Windows Update (August 10, 2006, 3:00am JST)

- Even the monthly (non-emergency) Windows Updates cause a 25% drop in total traffic.



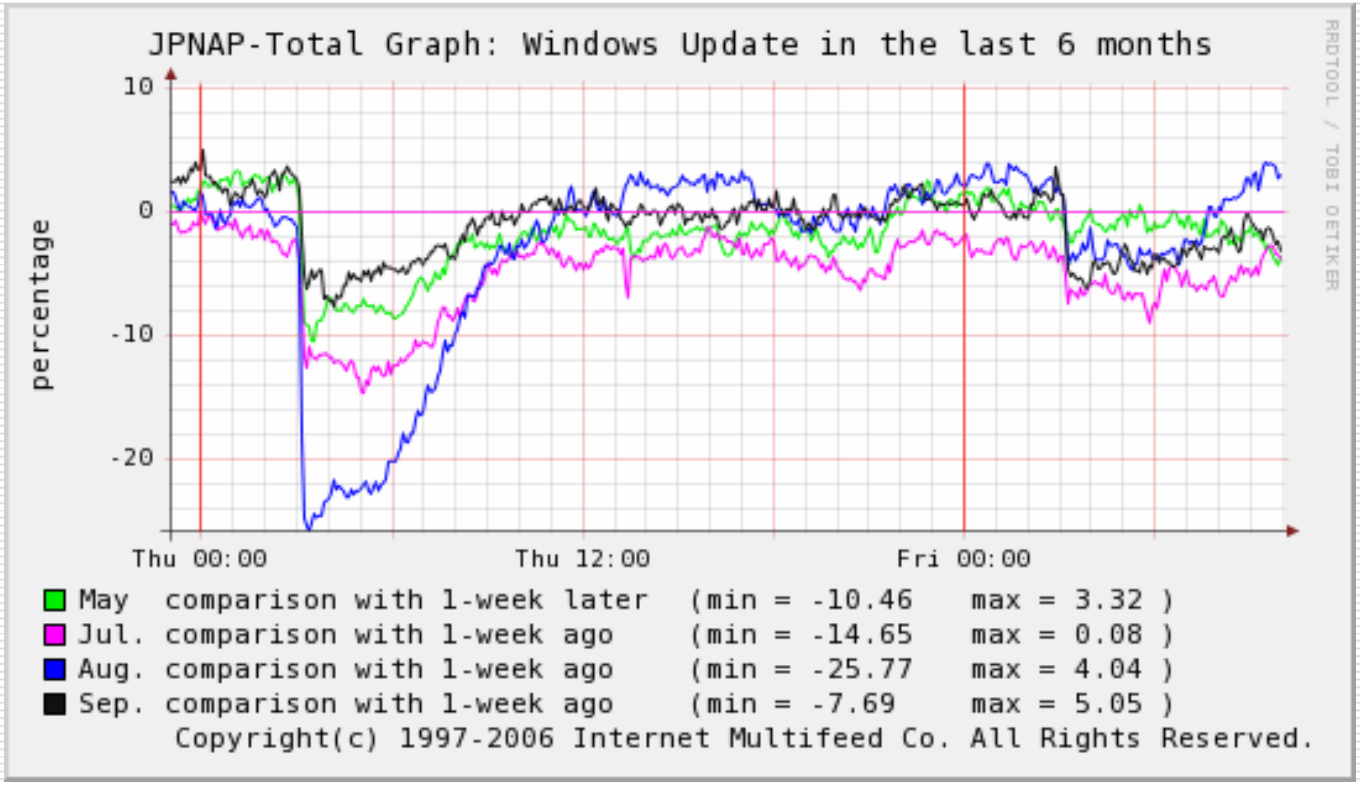
Percentile



Decrease up to 25% from 1 week ago

3-D. Windows Updates (in the last 6 months)

- Comparison of monthly Windows Updates over the previous 6 months.
  - What causes the dispersion (5 - 25%) ?
    - We have yet to figure it out.



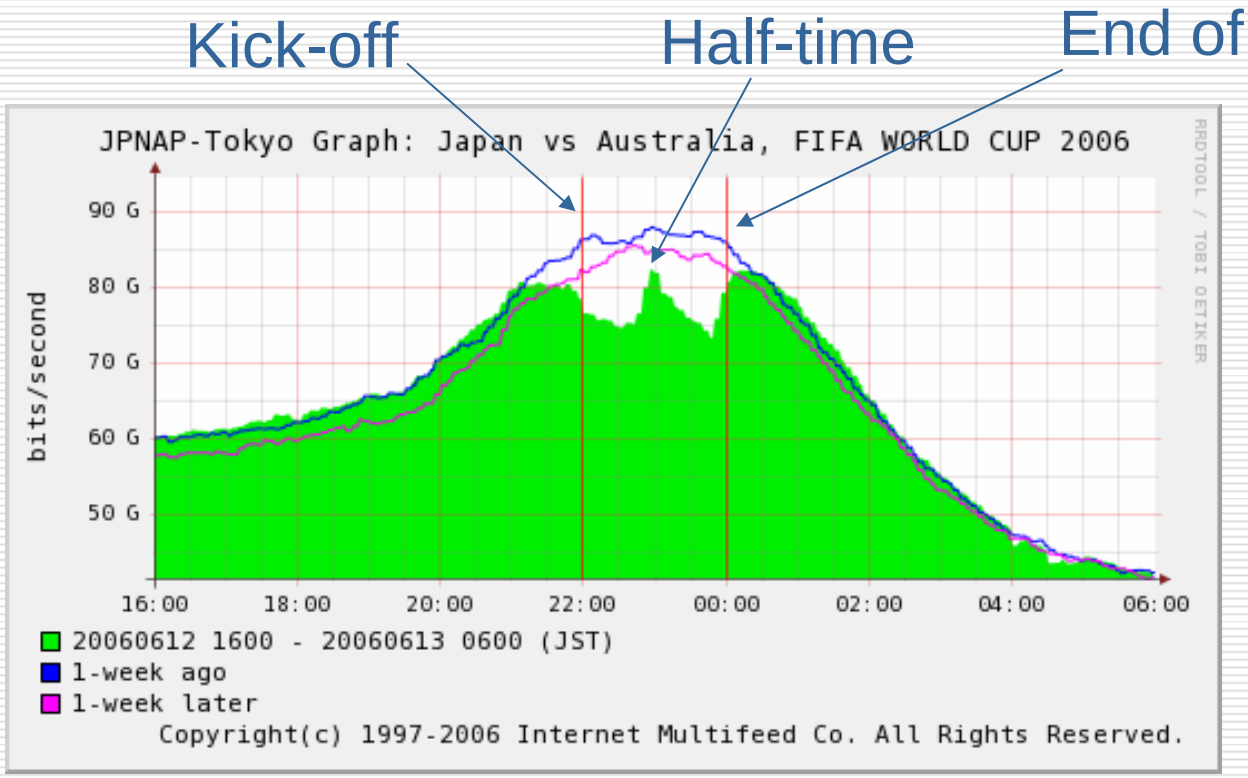
Percentile

4. Another sample

- Microsoft/Windows Updates
  - Emergency release
  - Monthly, regular release
- Social Events
  - Major sporting events
    - FIFA World Cup
    - ...

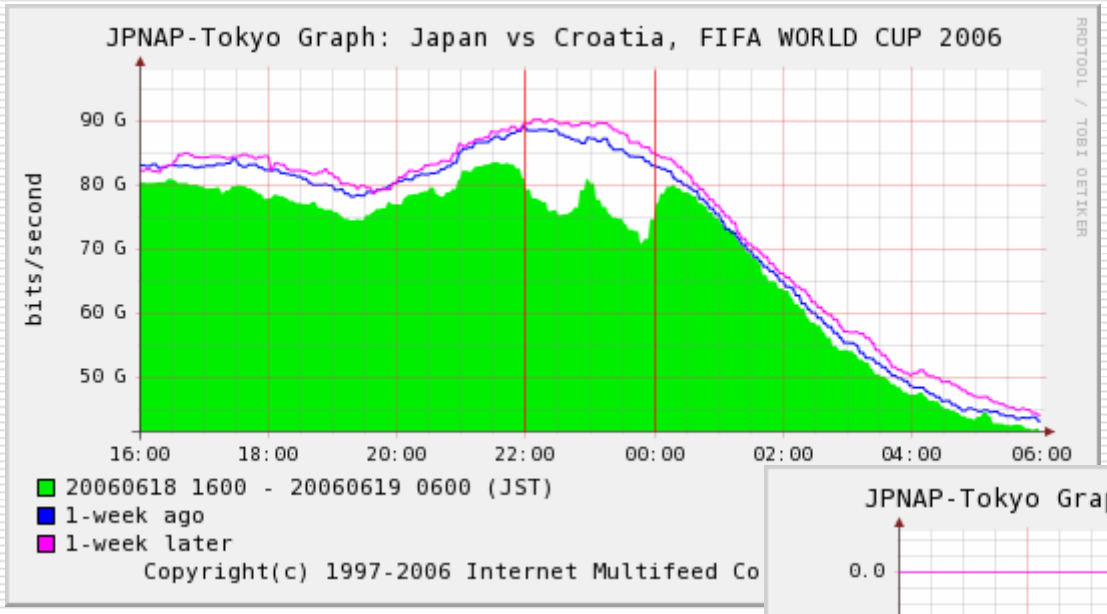
4-A. World Cup 2006 (Japanese team's 1st match)

- Japan's national team played their 1st match on a weeknight.
  - Kick-off at 10:00pm (Monday)
  - Decrease of 15% (maximum)

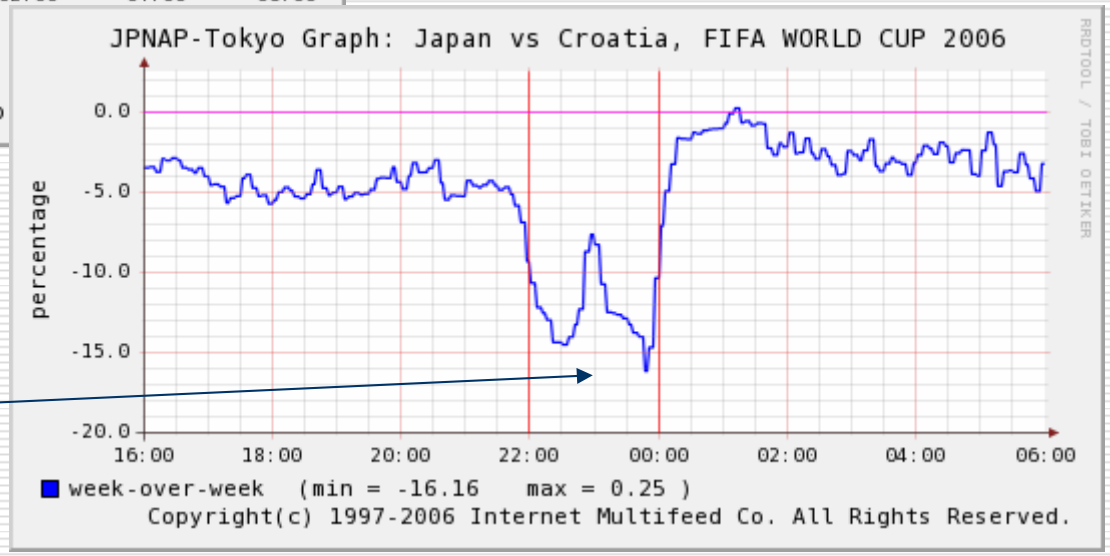


4-B. World Cup 2006 (2nd match)

- In local time, weekend night (Sunday)



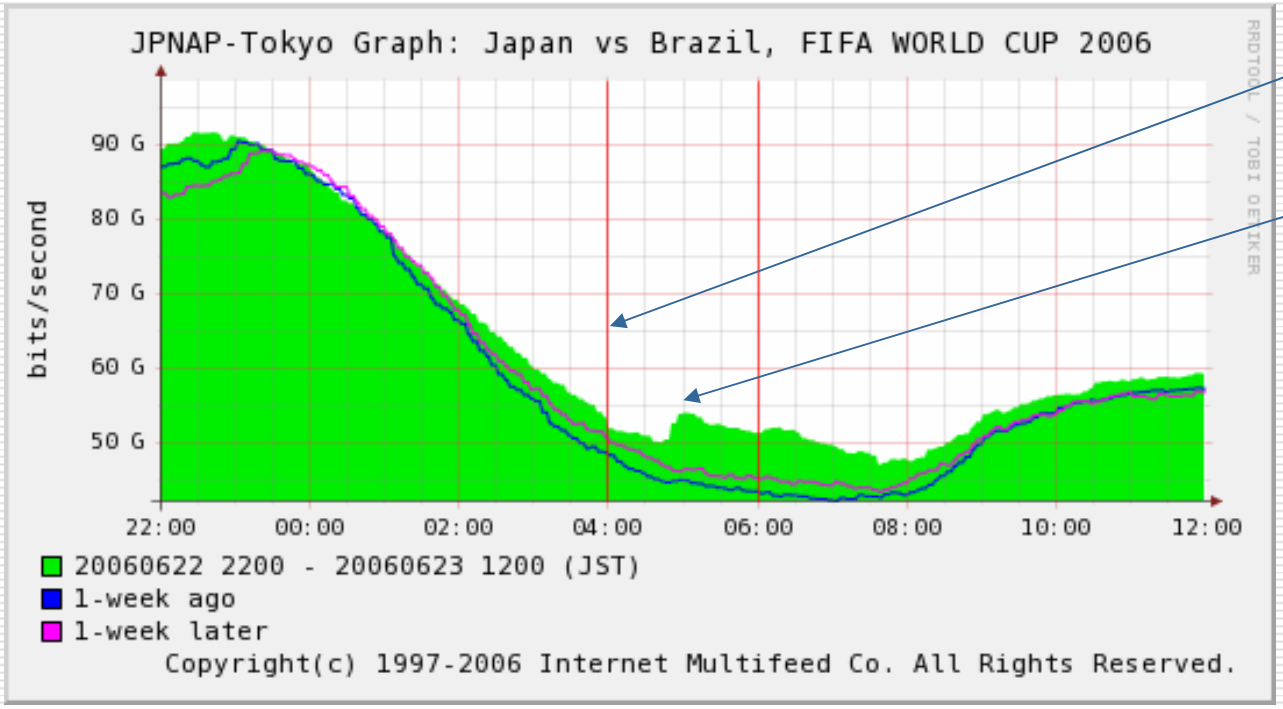
Percentile



Decrease up to 16% from 1 week ago

4-C. World Cup 2006 (3rd match)

- Early morning
  - Kick-off ... 4:00am (Friday)
  - Increase up to 21% (maximum)
    - Continued +5% after this match



Kick-off

Half-time

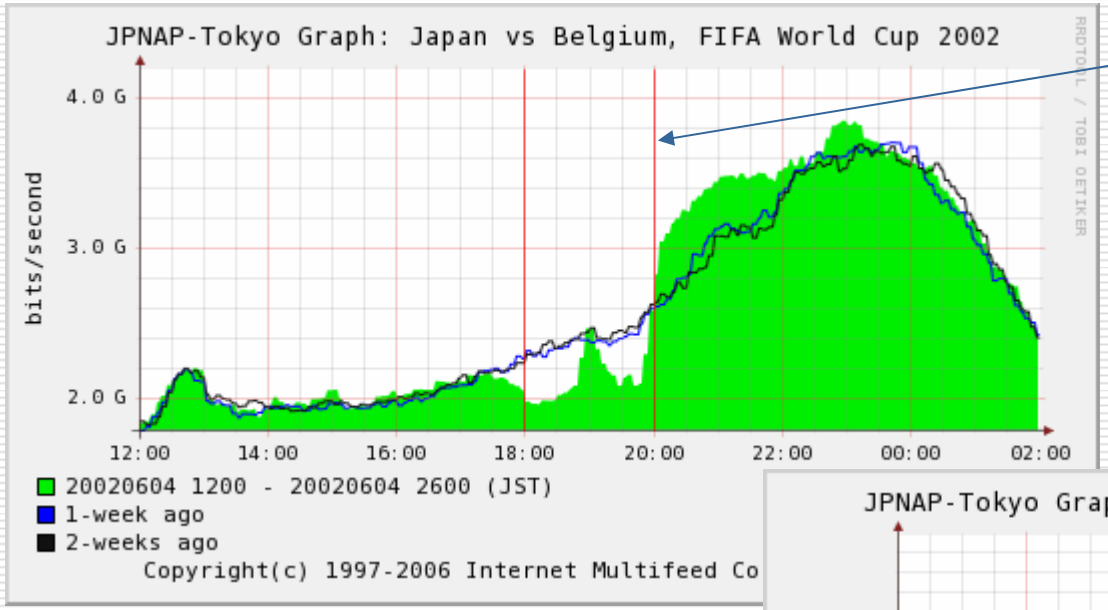
4-D. How about other IXes during World Cup matches?

- AMS-IX
  - Exactly the same trend
- DE-CIX
  - Impact of traffic much less than expected
- LINX
  - A little different
  - Games which held in the evenings or weekends - when people had access to a TV - caused a drop, except we saw mini-peaks at half-time.
  - Some games - the ones which were held while people were still at work, caused a small traffic increase, evidently pulling down streams or audio commentary.

4-E. World Cup 2002, Korea/Japan

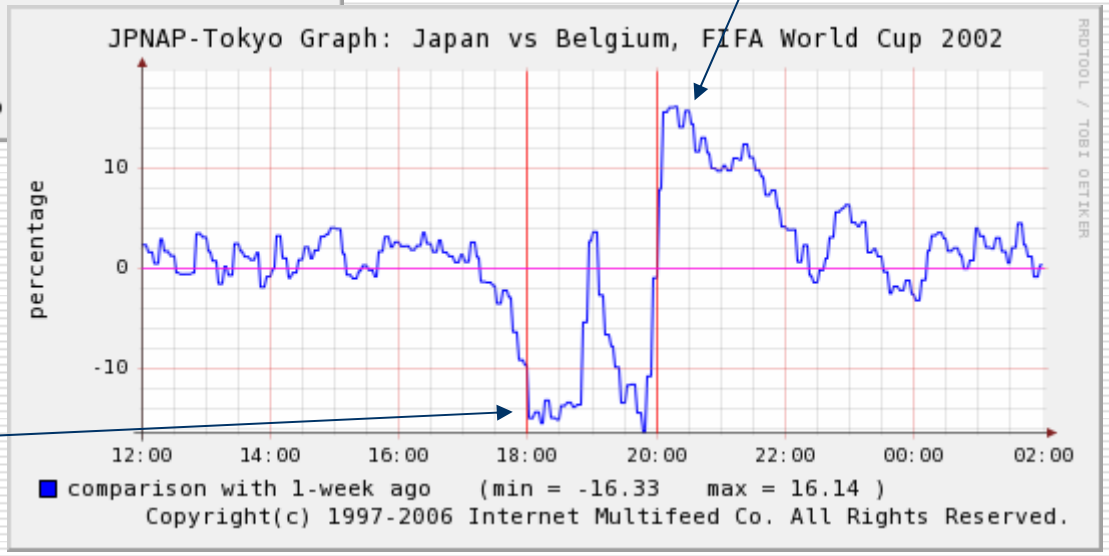
Statistics of 4 years ago

- We can confirm the same trend, again.



End of this match

Increase up to 16%



Decrease up to 16%
from 1 week ago

5. Other triggers?

- Sports events that attract many people
  - Boxing Title Matches
  - High School Baseball Championships
- Social incidents
  - Earthquakes
  - Massive Power Outages
  - Terrorist Attacks
  - Internet-related topics
    - Security issue

6. Summary (1)

- Traffic could shake up and down from +25% to -25% in major social event.
  - Major reasons
    - Machine behavior (ref. 3-A, B, C, D)
      - Quite a number of machines running P2P applications rebooted automatically due to Windows updates or security issues.
    - Human activities (ref. 4-A, B, C)
      - Because many people could access or leave their PCs during major social events, internet traffic will go up and down.

6. Summary (2)

- Engineers need to realize the possibility of such phenomena when they design networks or scheduled maintenances.
  - These trends are expected to continue in the foreseeable future.

- Further study
  - Compare other infrastructure utilizations with Internet traffic statistics
    - e.g. TV viewing rate
  - It might be the best approach to social engineering in the near future.

Q&A

- Feedback: tarui at mfeed.co.jp
- Stats
  - http://www.jpnap.net/snapshot/
- Acknowledgements
  - Ichiro Mizukoshi, NTT
  - Katsuyasu Toyama, NTT
  - Seiichi Kawamura, NEC BIGLOBE
  - Yasuo Igano, Verizon Business

Thank you.