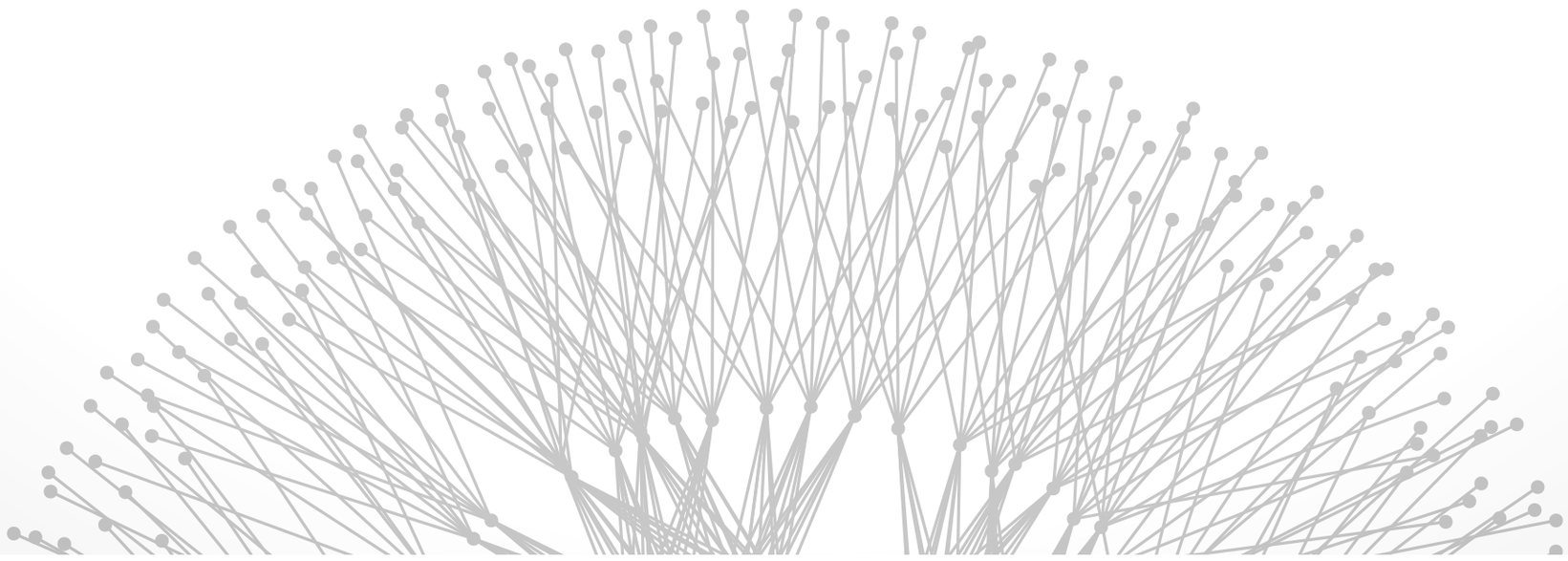
Network measurement

Brighten Godfrey

CS 538 November 8 2011



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Science of network measurement

Measurement goes back to the inception of the Internet

By the mid-1990s: Internet and its protocols were big, wild, organic

- Complex system: hard to predict effects of interacting components
- Distributed system: can't see everything that's happening

Network measurement moves from "just" monitoring to a science

Measuring the Internet

Key challenge: lack of visibility

- Only a small fraction of the system is visible
- For what we can observe, the cause is not obvious

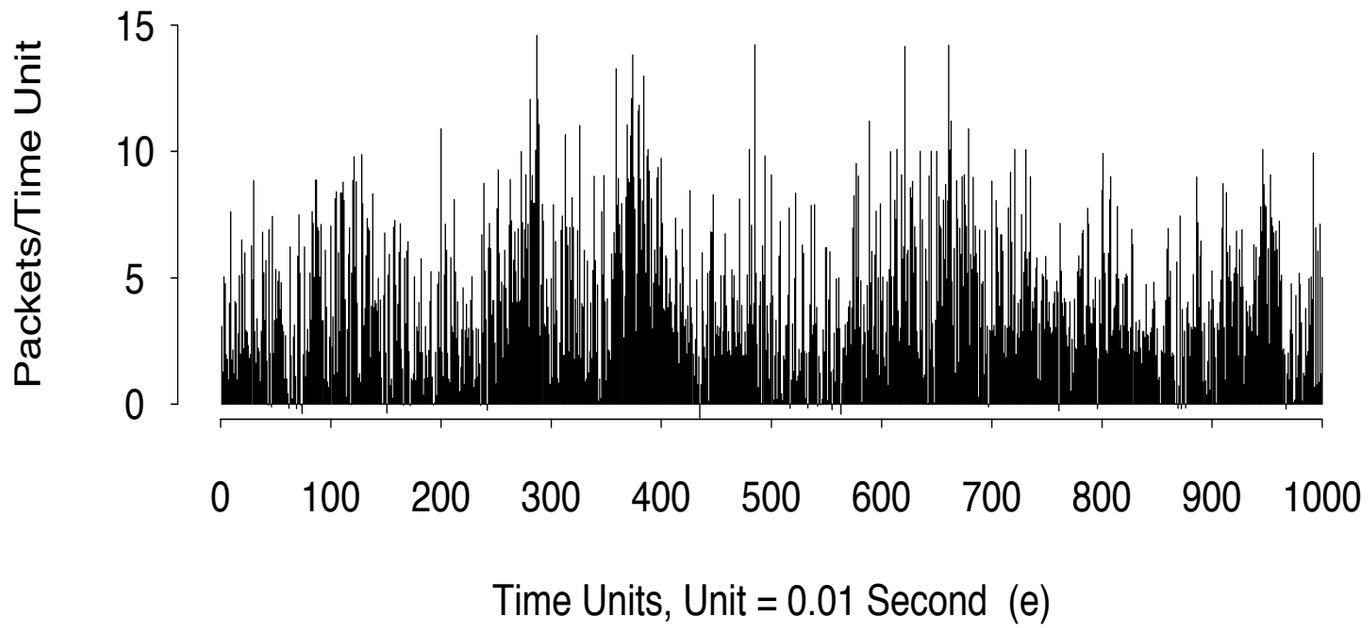
Foundational work by Paxson in the mid 1990s

- "End-to-End Routing Behavior in the Internet", SIGCOMM 1996
- Loops, asymmetry, instability
- Established Internet measurement methodology: "looking inside the black box" via end-to-end measurements

Of course, internal data is nice if you can get it...

Temporal patterns of traffic

"On the Self-Similar Nature of Ethernet Traffic"
Leland, Taqqu, Willinger, Wilson, SIGCOMM 1993



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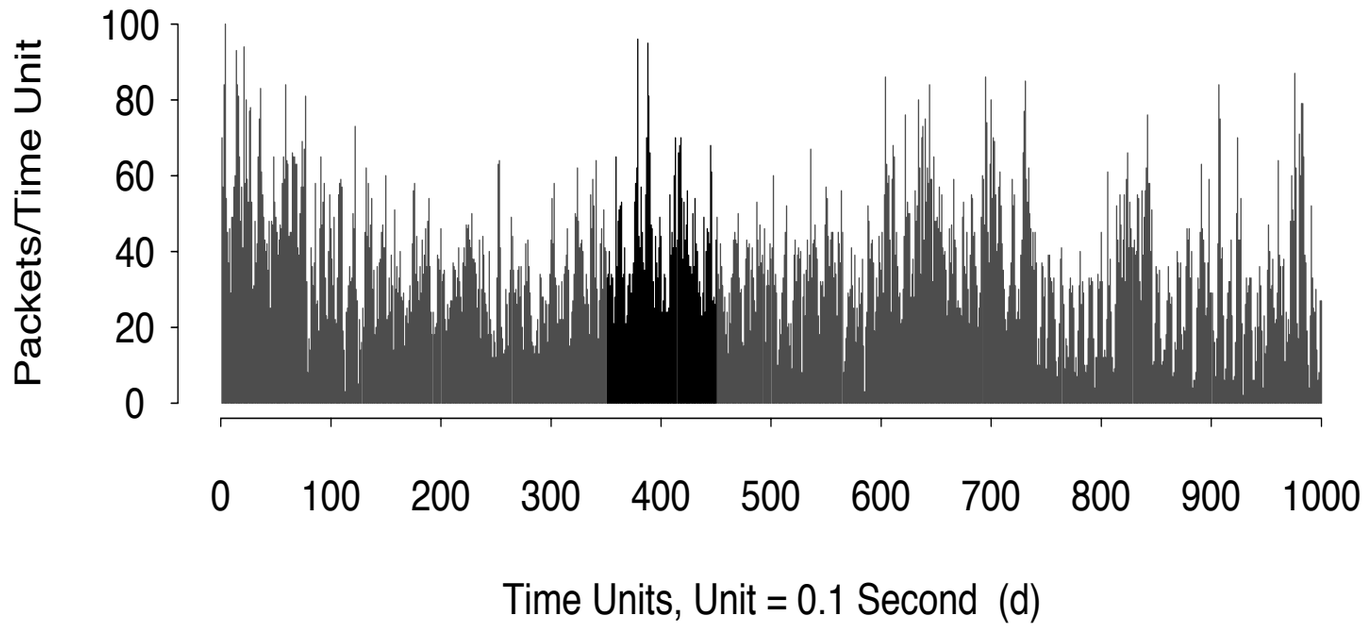

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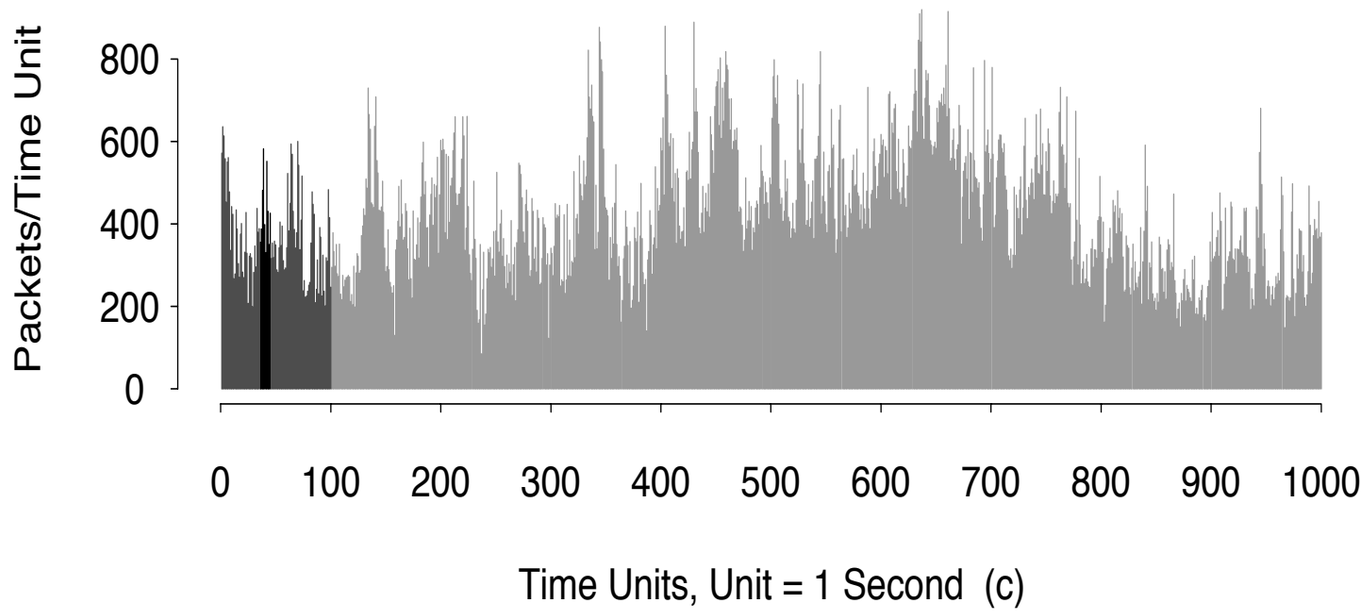

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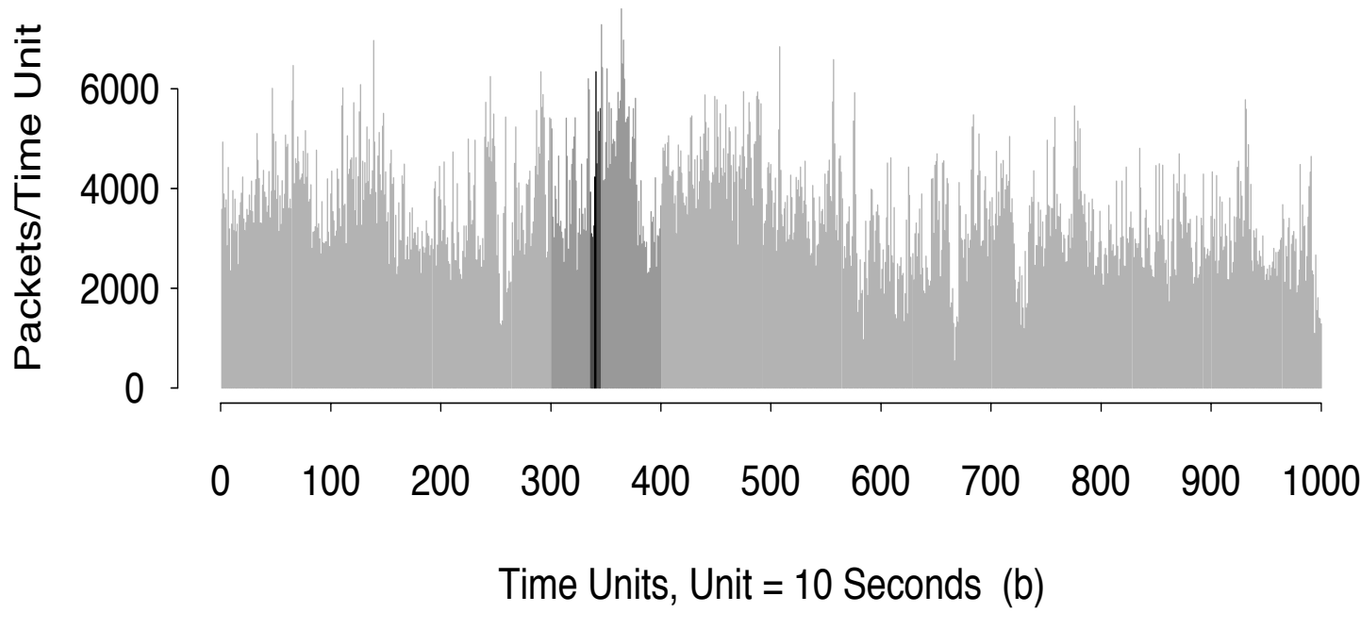

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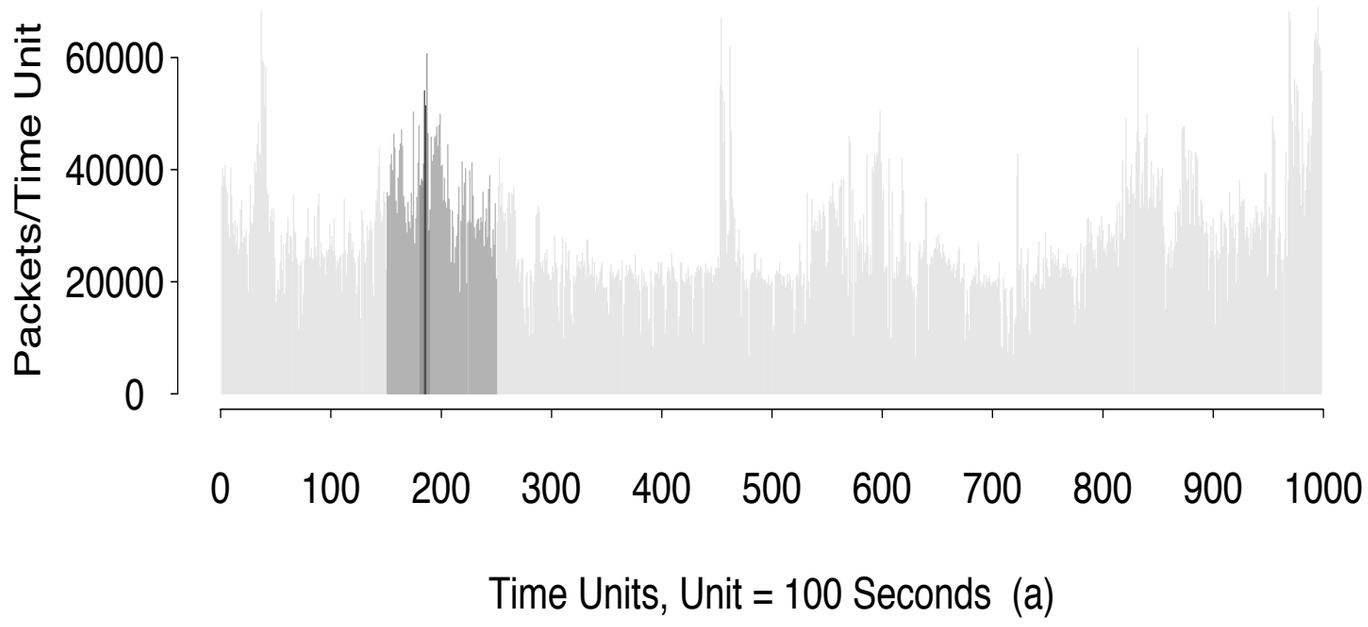

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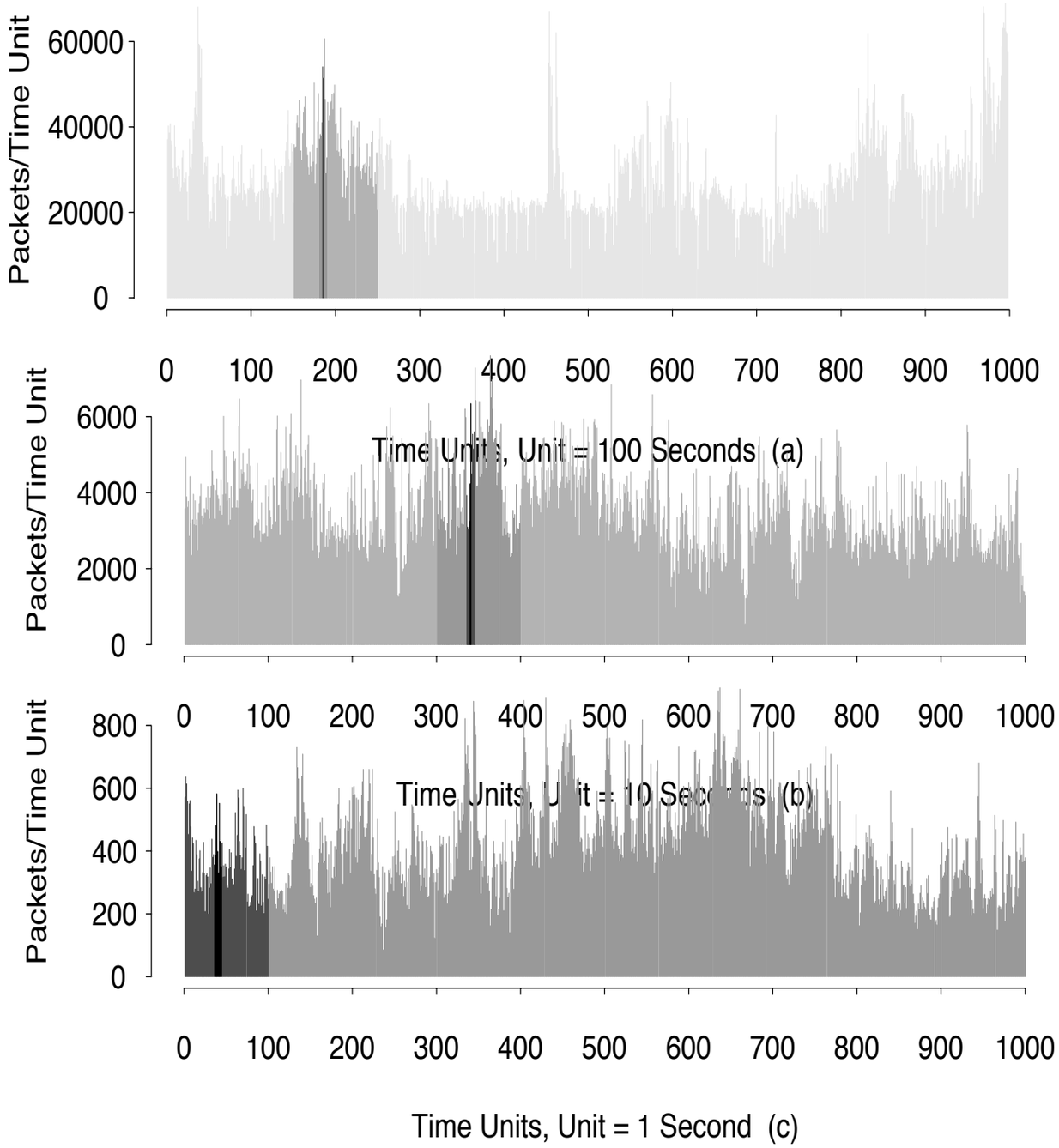

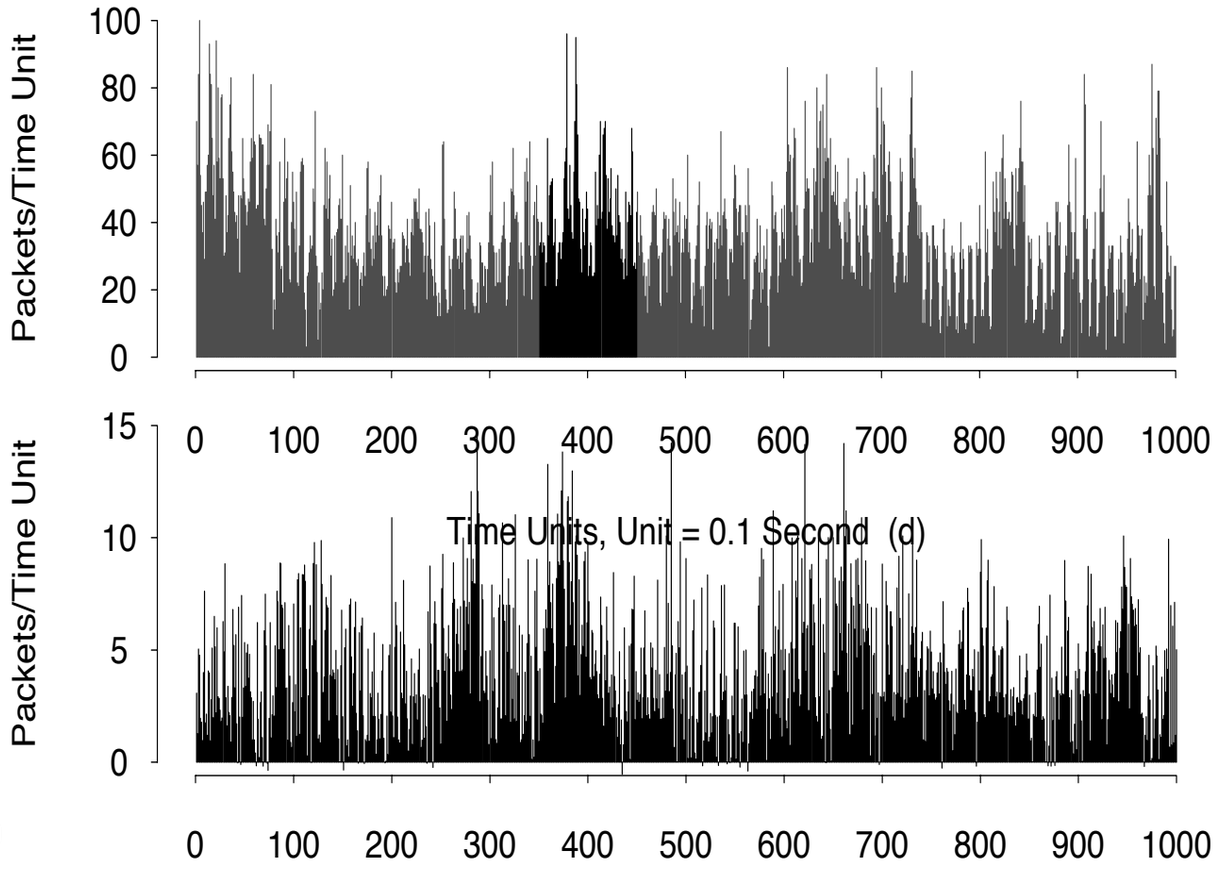

Bursty at all resolutions; Not captured by simple traffic models!

A word of caution

> *The most important difference between computer science and other scientific fields is that:* We build what we measure. *Hence, we are never quite sure whether the behavior we observe, the bounds we encounter, the principles we teach, are truly principles from which we can build a body of theory, or merely artifacts of our creations. ... this is a difference that should, to use the vernacular, 'scare the bloody hell out of us!'*

– John Day