APPLICATION LEVEL PERFORMANCE METRICS

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WHY IS MEASURING IMPORTANT?

"To measure is to know."
- *Lord Kelvin*

"If you can not measure it, you can not improve it."
- *Lord Kelvin*

"If you try to measure something accurately you will change something related"
- *Heisenberg's uncertainty principle*

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HOW TO DEFINE A GOOD METRIC ?

• The metrics must be concrete and well-defined

• A methodology for a metric should have the property that it is repeatable: if the methodology is used multiple times under identical conditions, the same measurements should result in the same measurements.

•The metrics must exhibit no bias for IP clouds implemented with identical technology

HOW TO DEFINE A GOOD METRIC ?

• The metrics must exhibit understood and fair bias for IP clouds implemented with non-identical technology

• The metrics must be useful to users and providers in understanding the performance they experience or provide,

• The metrics must avoid inducing artificial performance goals.

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A GOOD MEASUREMENT SYSTEM ?

- Direct measurement of a performance metric using injected test traffic.
- Projection of a metric from lower-level measurements.
- Estimation of a constituent metric from a set of more aggregated measurements.
- Estimation of a given metric at one time from a set of related metrics at other times
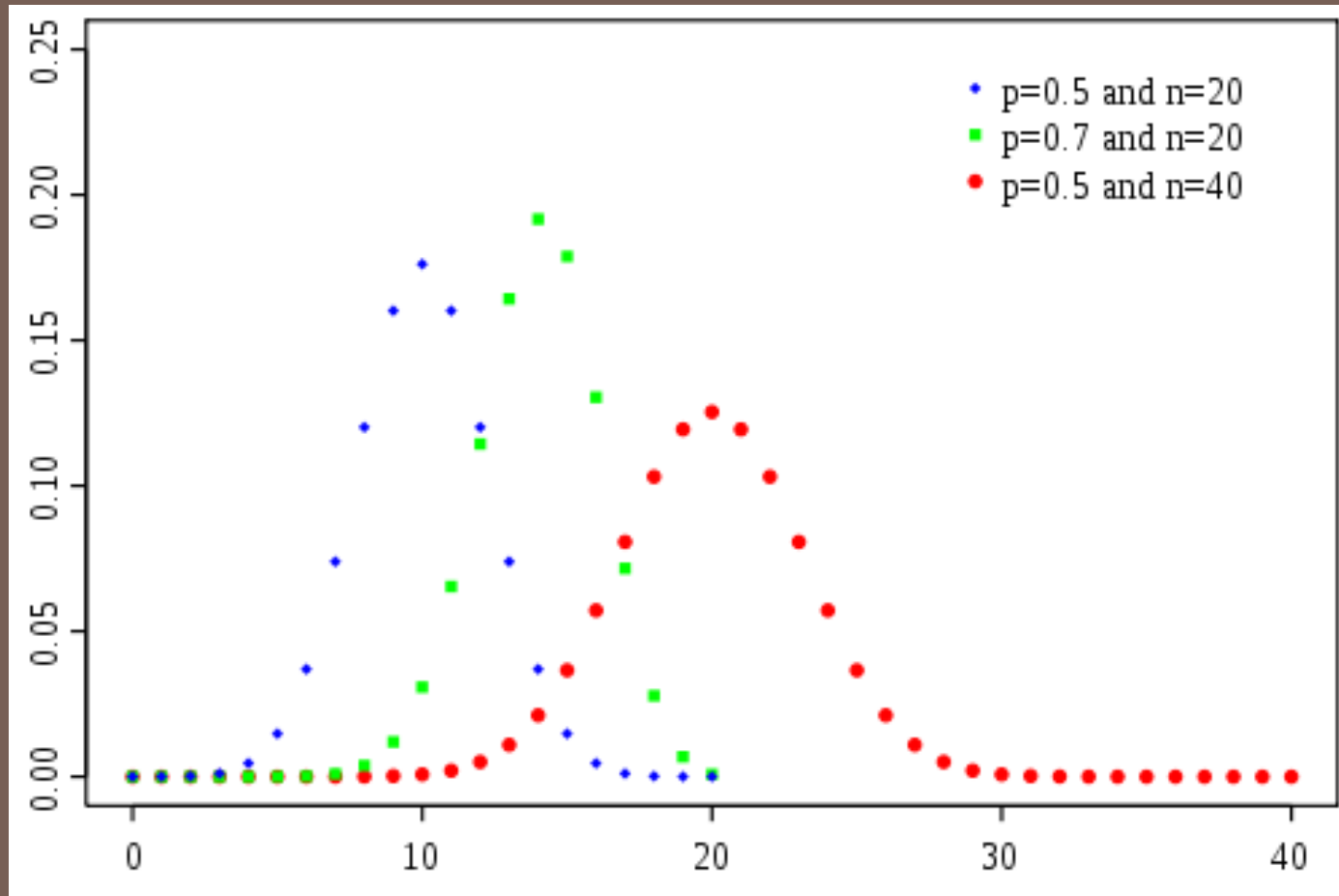
STATISTICS BACKGROUND

- Distributions
  1. Normal Distribution
  2. Poisson Distribution

NORMAL DISTRIBUTION
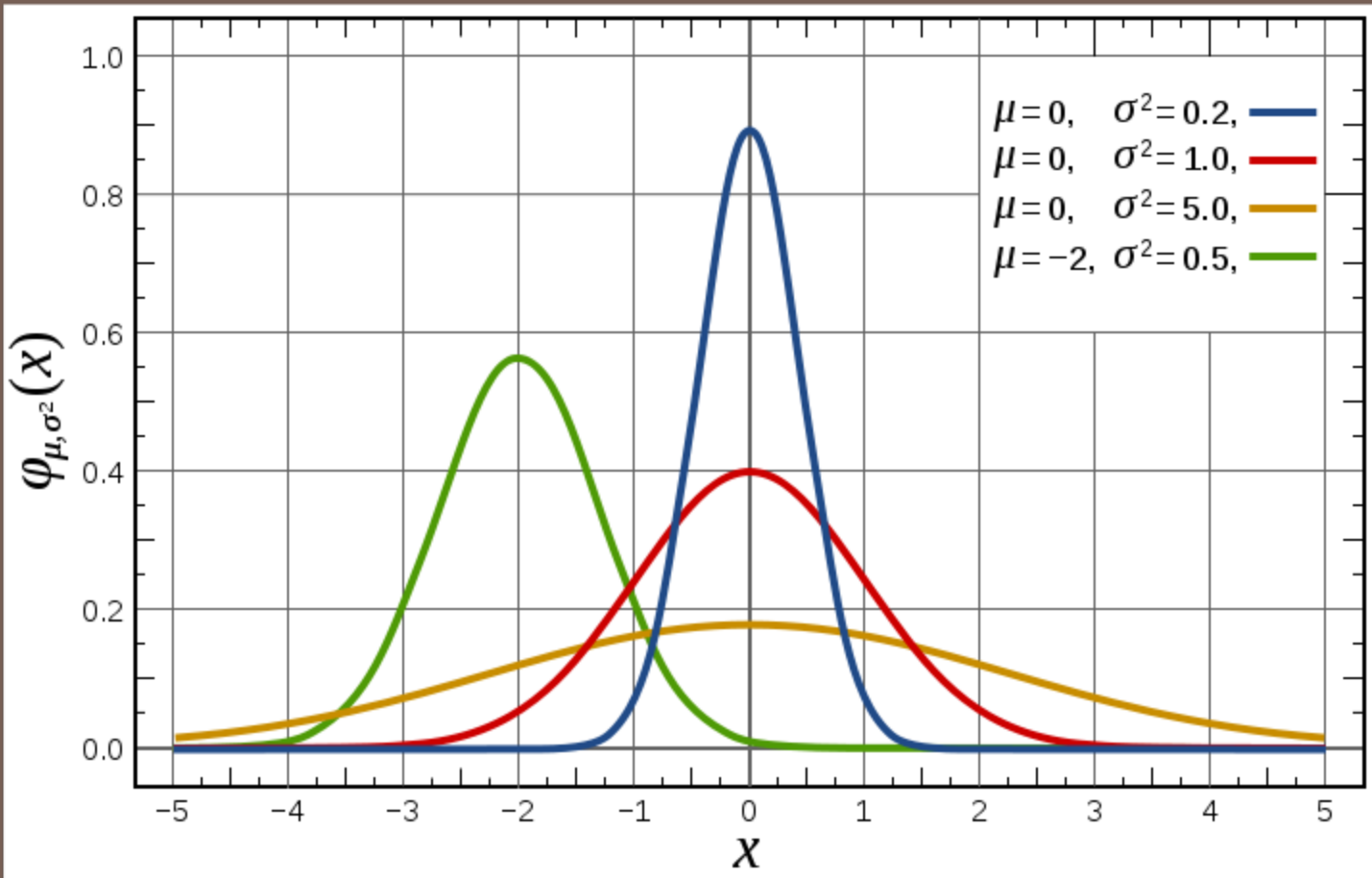
BINOMIAL DISTRIBUTION

STATISTICS BACKGROUND

- Population
- Mean
- Mode
- Median
- Outliers
- Percentile

SAMPLING OF DATA

- Sample should be representative of data
- The sampling should be properly randomized
- Anomalies can be missed or can be a significant contributor

IMPORTANT TERMS

- Bandwidth
- Latency
- Throughput

TYPES OF MEASUREMENT

- Active Measurement
- Passive Measurement

ACTIVE MEASUREMENT

- Typically uses sampling
- Great for outside-in performance measurement
- Artificial measurement
- Measurement framework could add it's own biases
- Lower coverage of data
- Sometime only practical alternative

PASSIVE MEASUREMENT

- Can take real life samples
- More real
- Have to deal with more data typically
- More Coverage
- Sampling can be used. Efficacy of sampling can be seen.
- Should remove outliers to sanitize data

APPLICATION MEASUREMENT

Problems
- All packets are not created equal
- Depend upon lower layers
- QoS in the underlying network can treat different packets differently
- Software Behavior at end-points
- Codec-issues and sync problems
- Out of order packets
- Asymmetric routing

GOTCHAS

- Nagle's algorithm
- AIMD algorithm
- Other algorithms
- Caching effects

PING FOR LATENCY MEASUREMENT

Not a good idea Why ?

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PING FOR LATENCY MEASUREMENT

Not a good idea Why ?

- Ping blocked at some end-points
- ICMP is heavily deprioritized in some networks
- Asymmetric routing can skew times

The case against traceroute and tcptraceroute

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HTTP LATENCY MEASUREMENT

- HEAD
- GET
- POST
- PUT

Effect of different Headers and tuning parameters on response times

HTTP(S) LATENCY MEASUREMENT

Breakup of different components
- DNS Resolution
- Connection Time
- SSL Handshake Time
- Request Time
- First Byte Time
- Base Page Download Time
- Embedded Content Download Time

DEMO

Webpagetest

STREAMING LATENCY MEASUREMENT

Higher level metrics
* DNS Resolution time
* Initial Buffering time
* Rebuffer time
* Number of Rebuffers

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STREAMING LATENCY MEASUREMENT

Lower level metrics
- Loss of packets with Key frames
- Out of order packets
- Congestion delays

NETWORK ARCHITECTURE

- Example of an Active measurement Network
- Example of a Passive measurement network

IETF WORKING GROUPS

- IPPM
- PMOL
- BMWG

REFERENCES

Conferences
- Passive and Active Measurement conference
  http://www.pamconf.net/
- Internet Measurement Conference
  http://conferences.sigcomm.org/imc/
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REFERENCES

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* High Performance Websites
* Even Faster Websites
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RFCs
* IPPM Metrics for Measuring Connectivity RFC 2678
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Thanks

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