

RIS RIPENCC & Oregon Routeviews

**A Comparative Analysis of Timing Characteristics of
Global Prefix Attribute Changes**

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Agilent Technologies

Innovating the HP Way

Agenda

- **Rationale**
- **Measurement taxonomy**
- **Methodology**
- **Results**
- **Conclusions**
- **Next steps**
- **References**
- **Credits**



Measurement taxonomy

[LA99]

- **Tup & Tdown:** Fluctuations in the reachability for a given prefix. An announced route is withdrawn and transitions down (Tdown), or a currently unreachable prefix is announced as reachable and transitions up (Tup).
- **WWDup:** The repeated transmission of BGP withdrawals for a prefix that is currently unreachable.
- **AADup:** A route is implicitly withdrawn and replaced with a duplicate of the original route. [...] a *duplicate route* does not differ in any BGP path attribute information.
- **AADiff:** A route is implicitly withdrawn and replaced by an alternative route as the original route becomes unreachable, or a preferred alternative path becomes available
- **Flap:** Tdown followed by Tup where the prefix has identical attributes when first announced and then re-announced after a withdrawal.

Rationale

- **Determine the degree of similarity between measurements taken at RIPENCC and Oregon Routeviews as part of our related project that aims to identify BGP traffic patterns.**
- **Verify that Oregon Routeviews is a valid data collection point in light of the issues raised by [WA02] (multi-hop EBGP)**

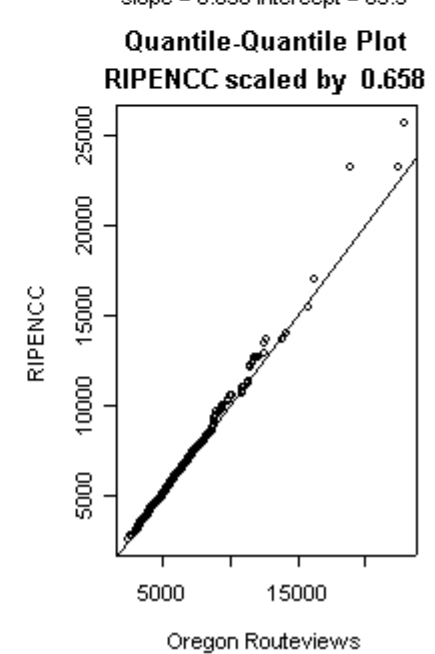
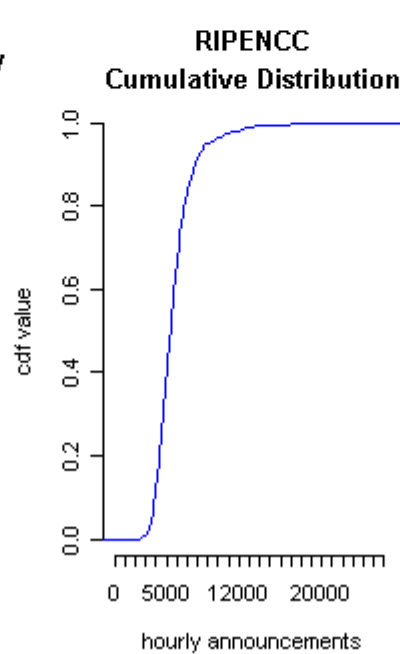
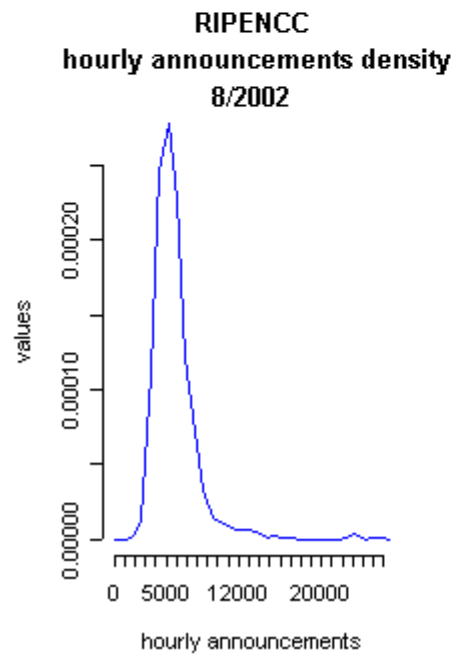
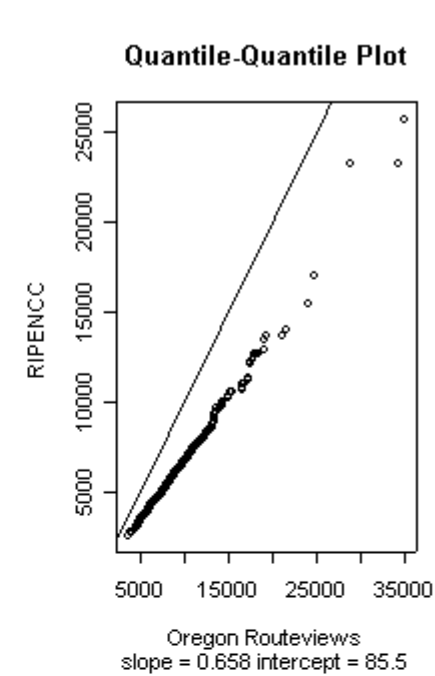
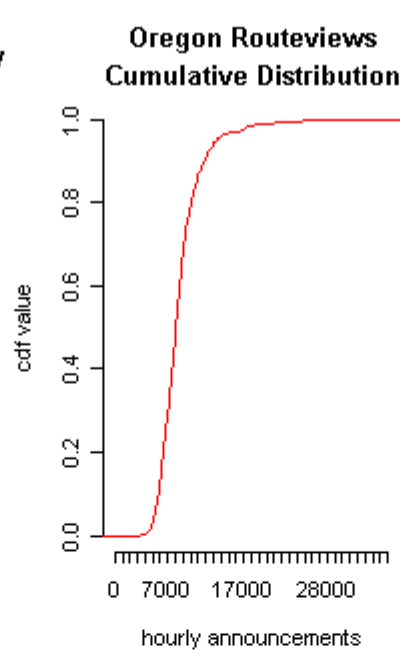
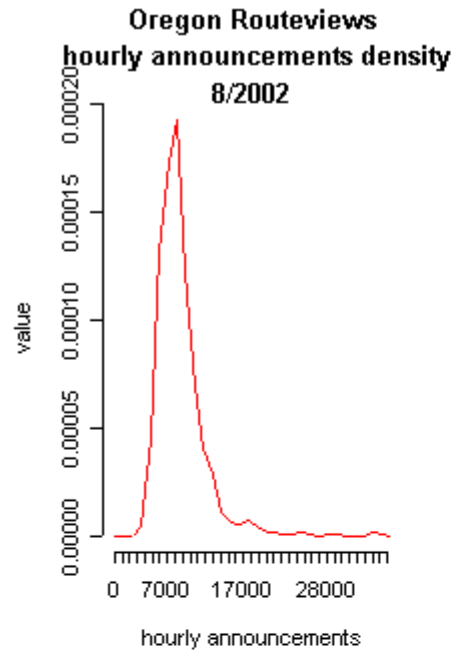
Methodology

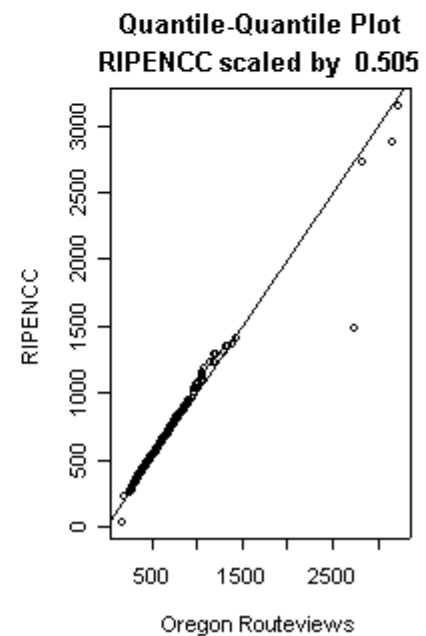
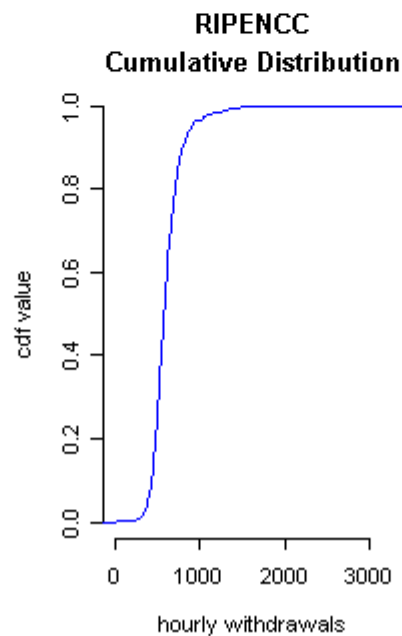
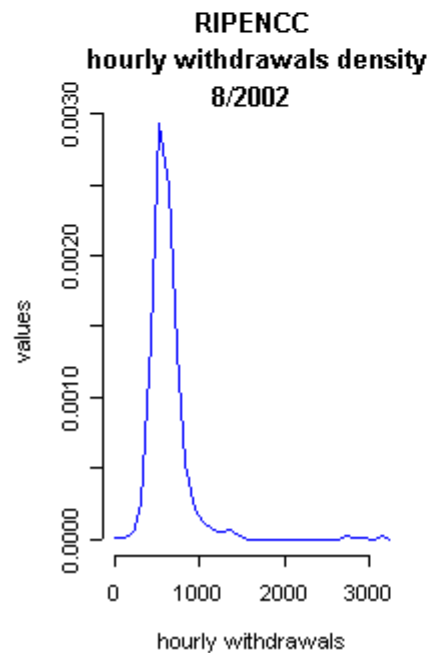
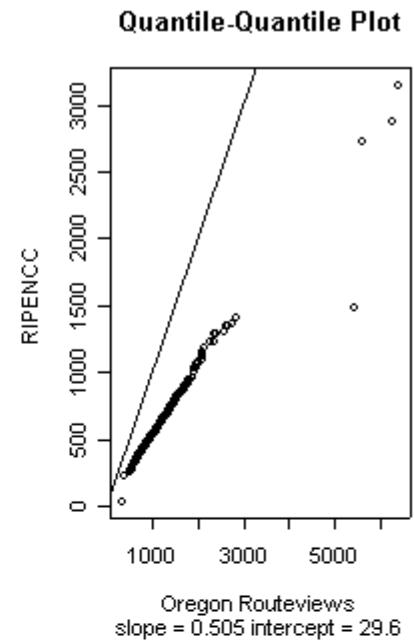
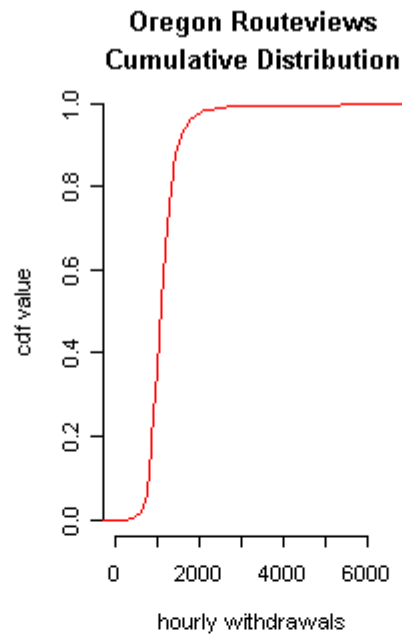
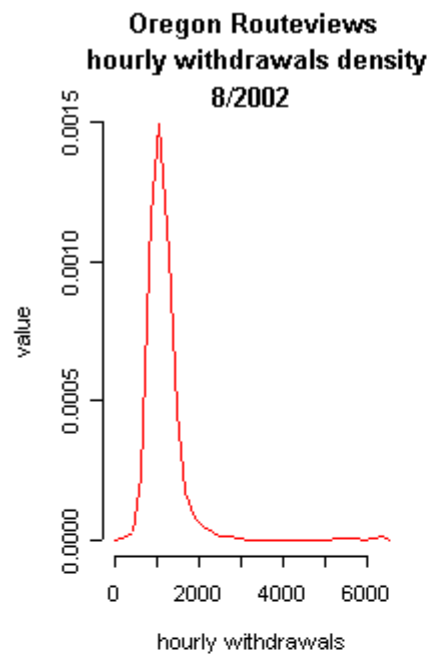
- **select all prefixes that show daily activity during 8/2002 at both RIPENCC & Oregon Routeviews (897)**
- **obtain:**
 - **hourly announcements, withdrawals, duplicate announcements, flaps, AS path & community changes**
 - **flap and duplicate announcement duration**
- **compute:**
 - **time series cross-correlation and distribution similarity for hourly measurements**
 - **distribution similarity for duration measurements**

Conclusion I

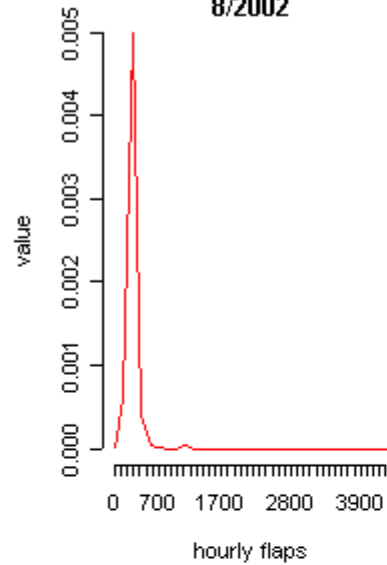
- **quantile-quantile plots demonstrates that Oregon Routeviews & RIPENCC distributions are similar to each other for several measurements**
- **such high level of similarity could not arise on account of chance alone**
- **we conclude that we are measuring the same object (a common set of prefixes)**



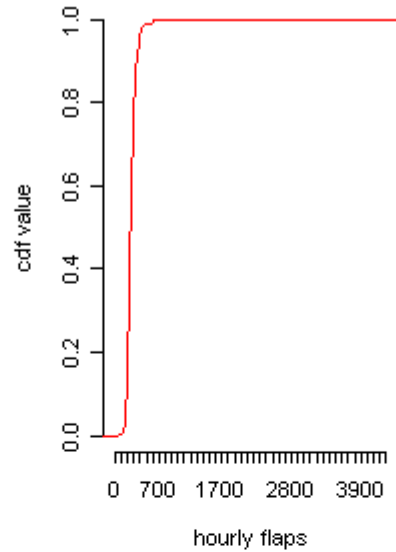




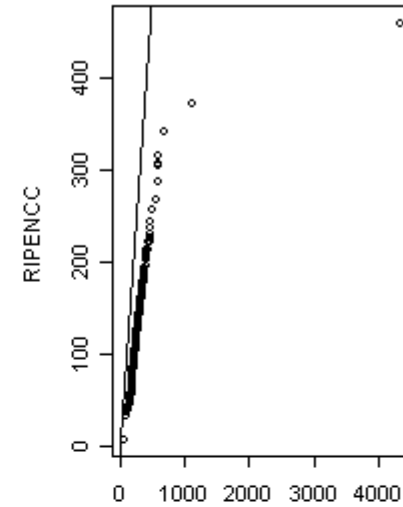
**Oregon Routeviews
hourly flaps density
8/2002**



**Oregon Routeviews
Cumulative Distribution**

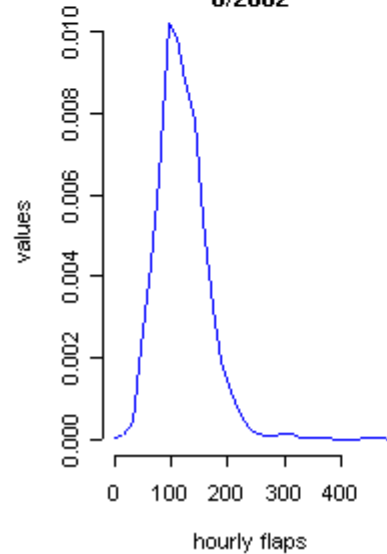


Quantile-Quantile Plot

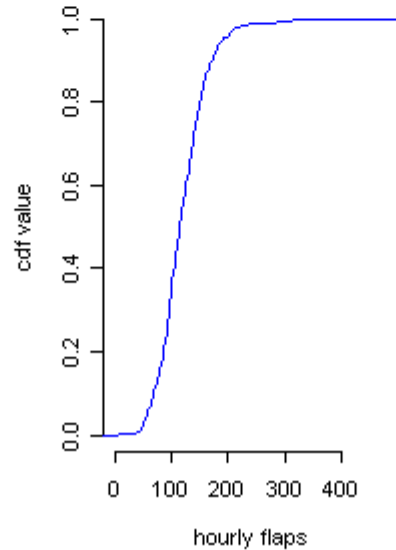


Oregon Routeviews
slope = 0.646 intercept = -46.8

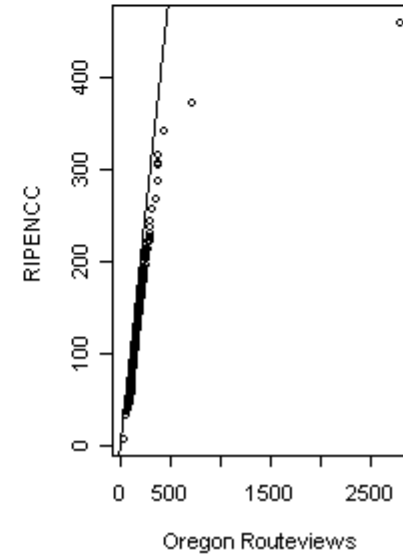
**RIPENCC
hourly flaps density
8/2002**



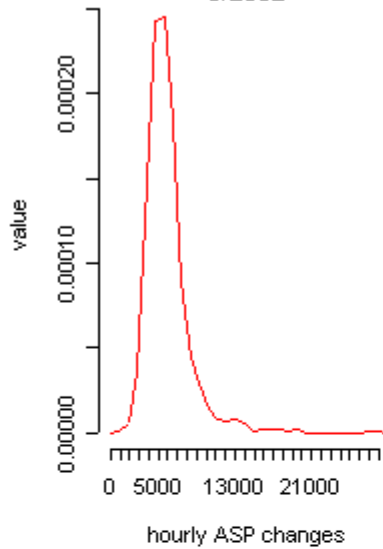
**RIPENCC
Cumulative Distribution**



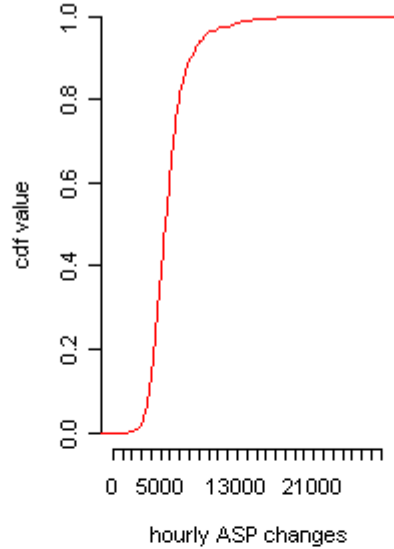
**Quantile-Quantile Plot
RIPENCC scaled by 0.646**



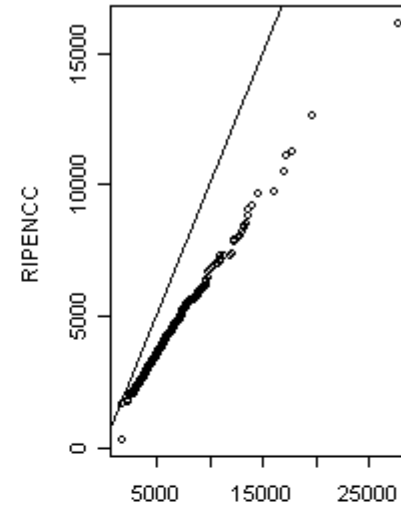
**Oregon Routeviews
hourly ASP changes density
8/2002**



**Oregon Routeviews
Cumulative Distribution**

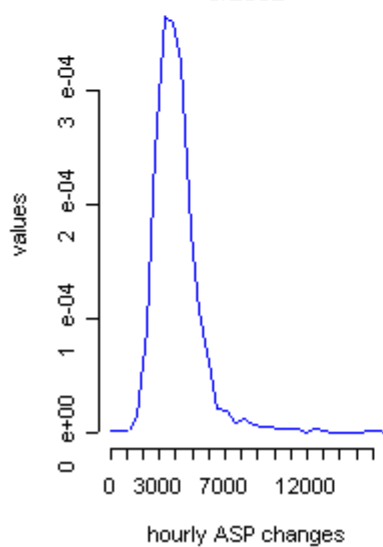


Quantile-Quantile Plot

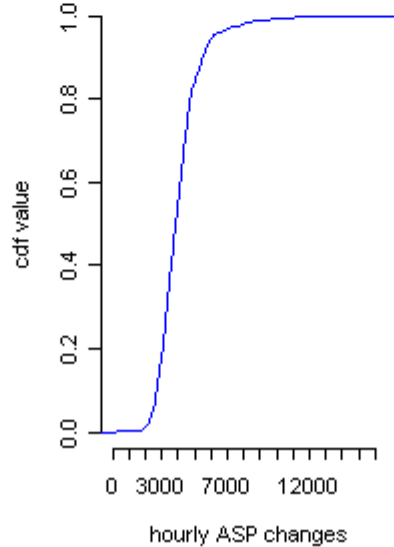


Oregon Routeviews
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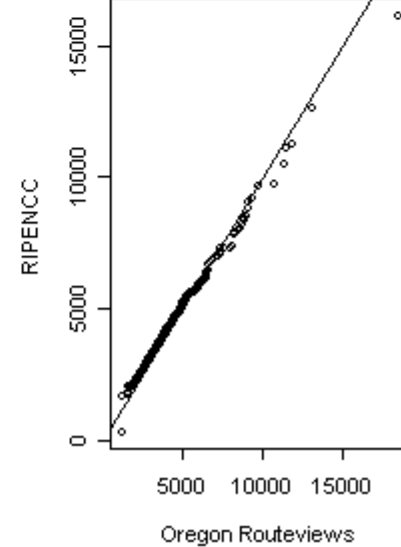
**RIPENCC
hourly ASP changes density
8/2002**



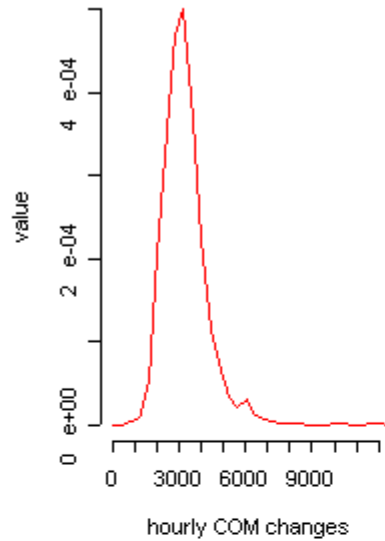
**RIPENCC
Cumulative Distribution**



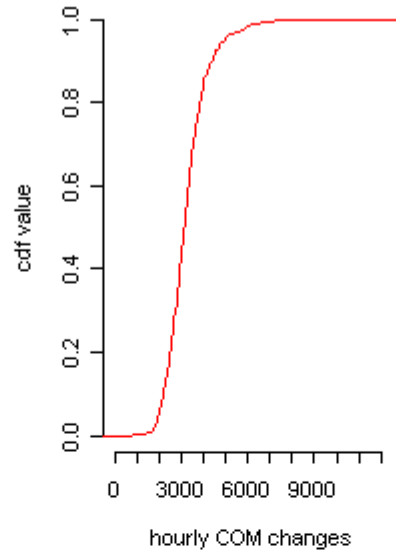
**Quantile-Quantile Plot
RIPENCC scaled by 0.668**



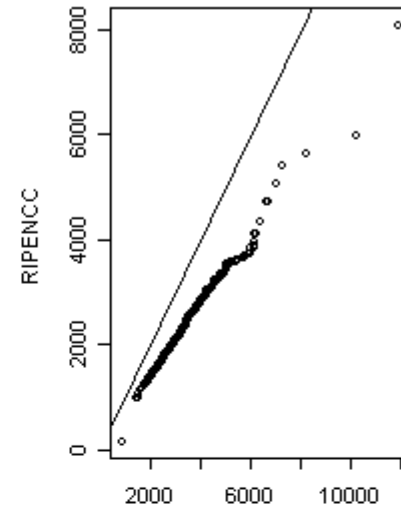
**Oregon Routeviews
hourly COM changes density
8/2002**



**Oregon Routeviews
Cumulative Distribution**

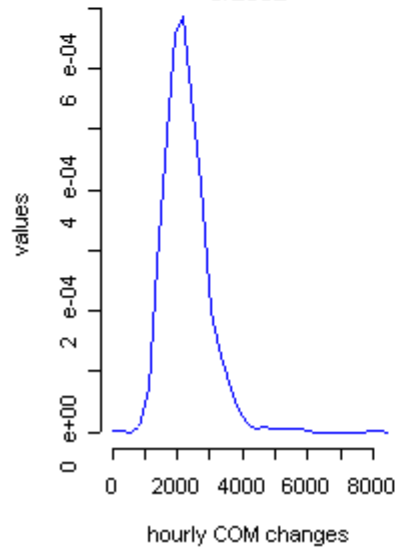


Quantile-Quantile Plot

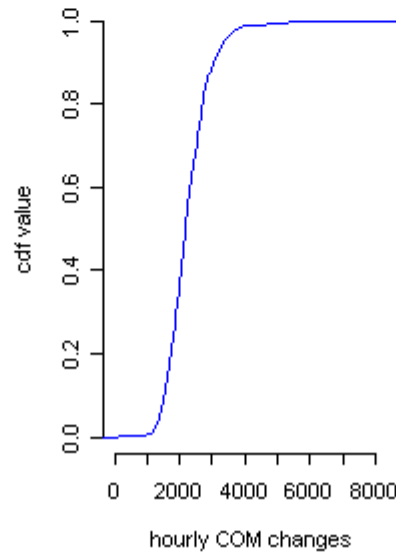


Oregon Routeviews
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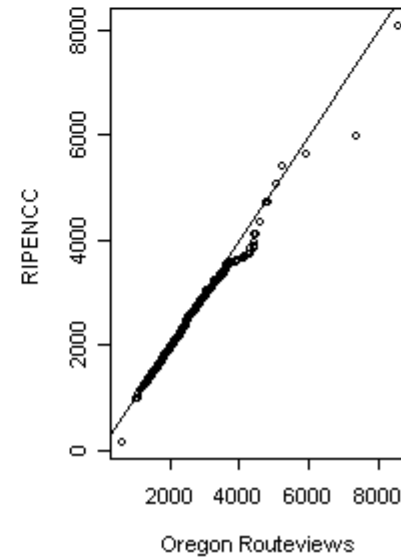
**RIPENCC
hourly COM changes density
8/2002**



**RIPENCC
Cumulative Distribution**



**Quantile-Quantile Plot
RIPENCC scaled by 0.722**

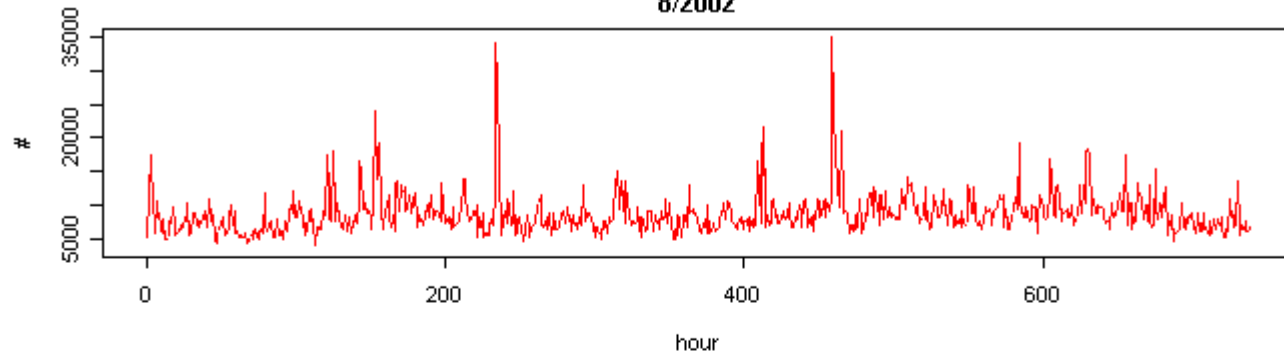


Conclusion II

- **there is a statistically significant cross-correlation between the time series of several measurements at Oregon Routeviews & RIPENCC**
- **the strongest cross-correlation occurred at a lag of -3 hours (shifting RIPENCC backward 3 hours)**
- **some measurements demonstrate higher cross-correlation than others**
- **we conclude that measurement pairs are dependent on the same underlying object (a common set of prefixes)**

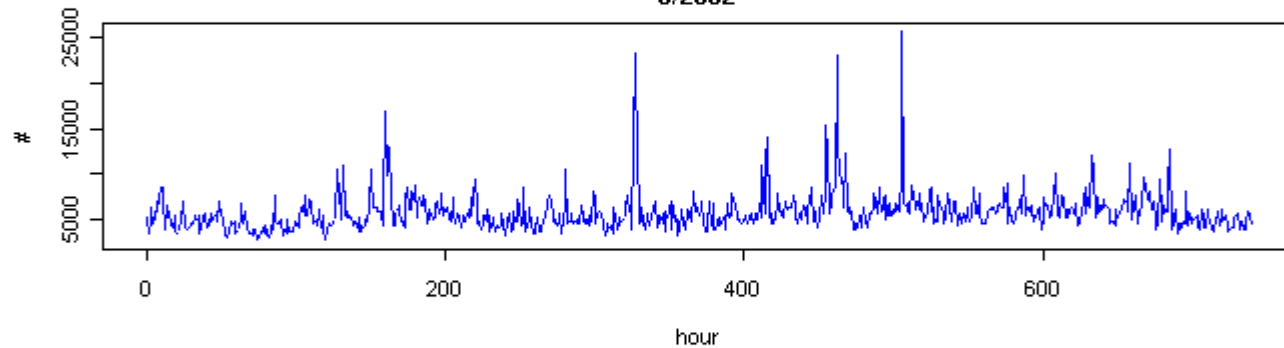
Oregon Routeviews Hourly announcements

8/2002

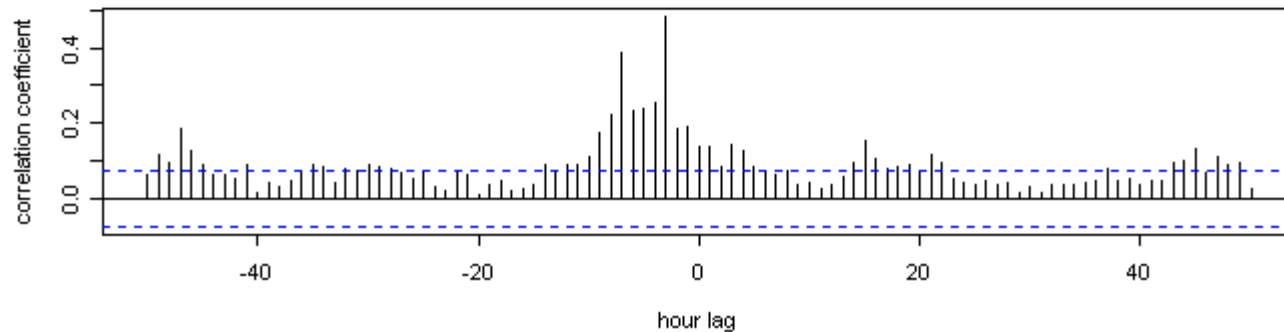


RIPENCC Hourly announcements

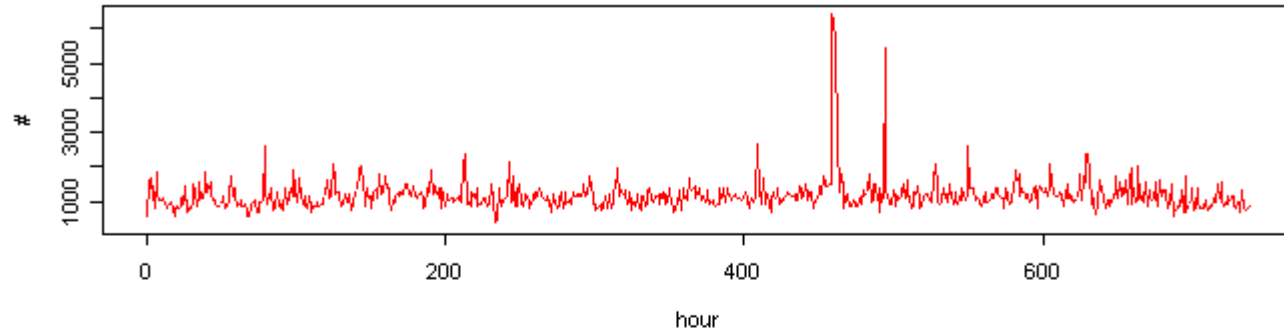
8/2002



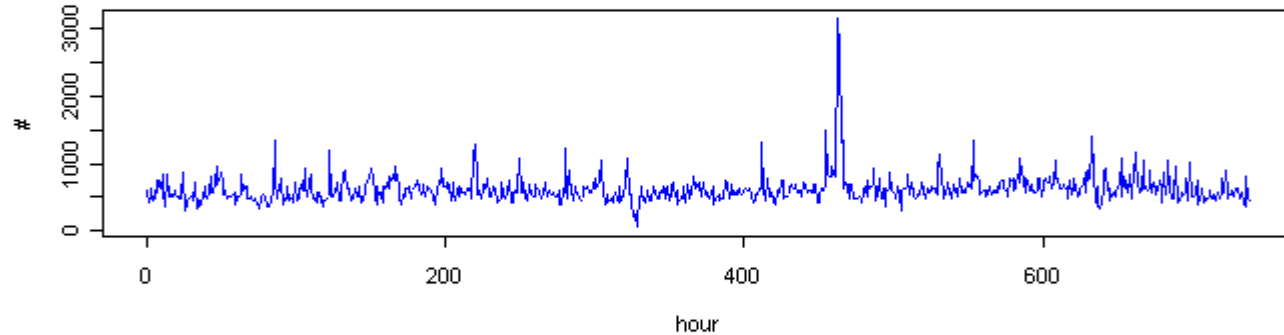
Cross Correlation



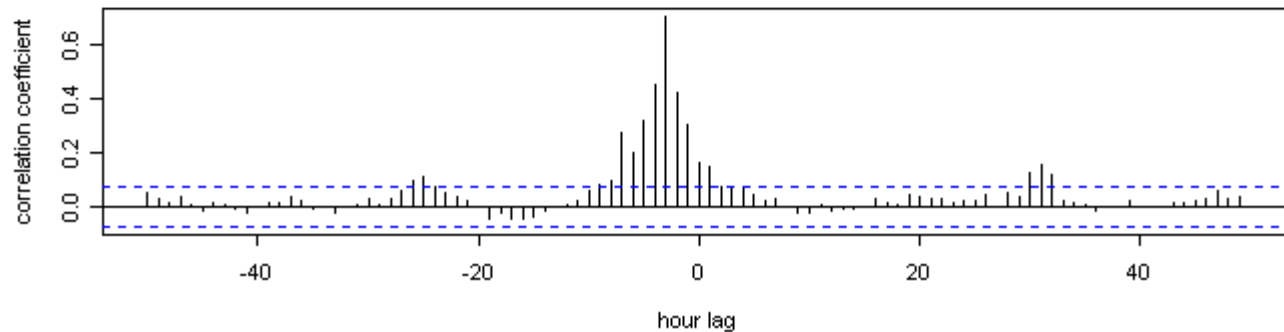
Oregon Routeviews Hourly withdrawals 8/2002



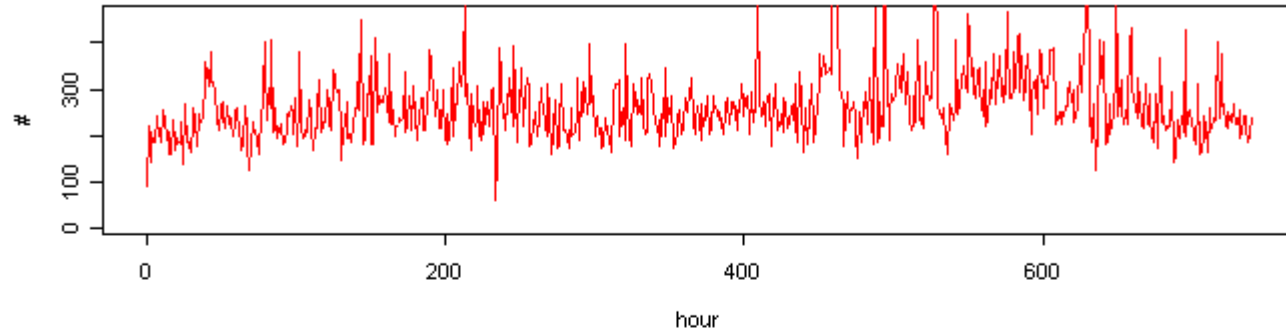
RIPENCC Hourly withdrawals 8/2002



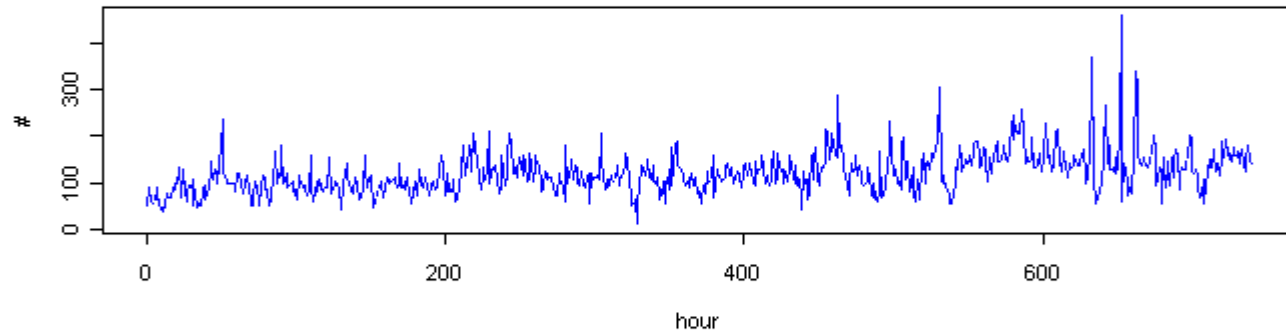
Cross Correlation



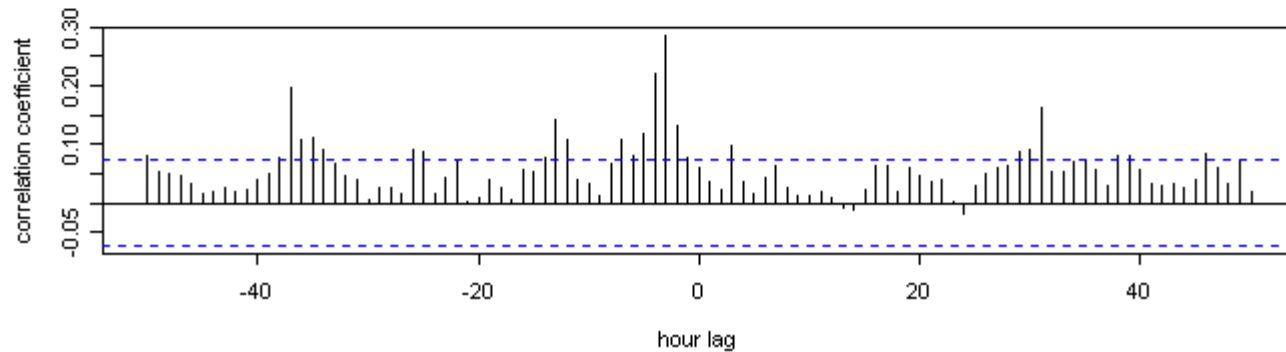
Oregon Routeviews Hourly flaps
8/2002



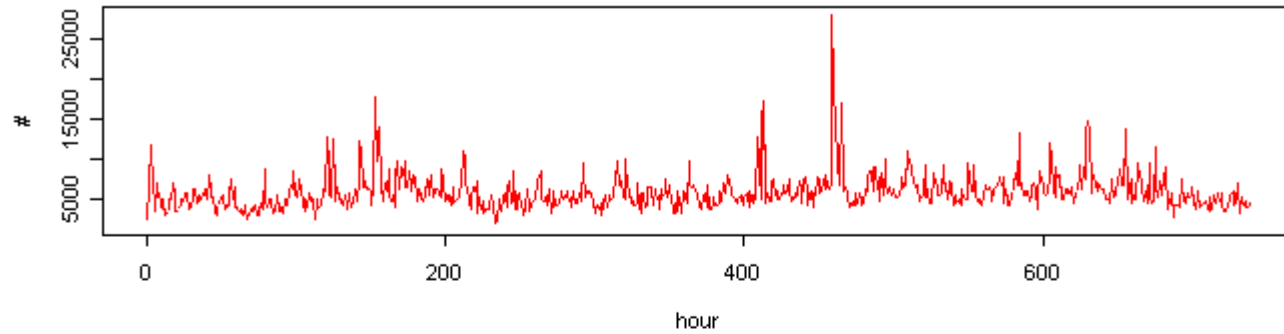
RIPENCC Hourly flaps
8/2002



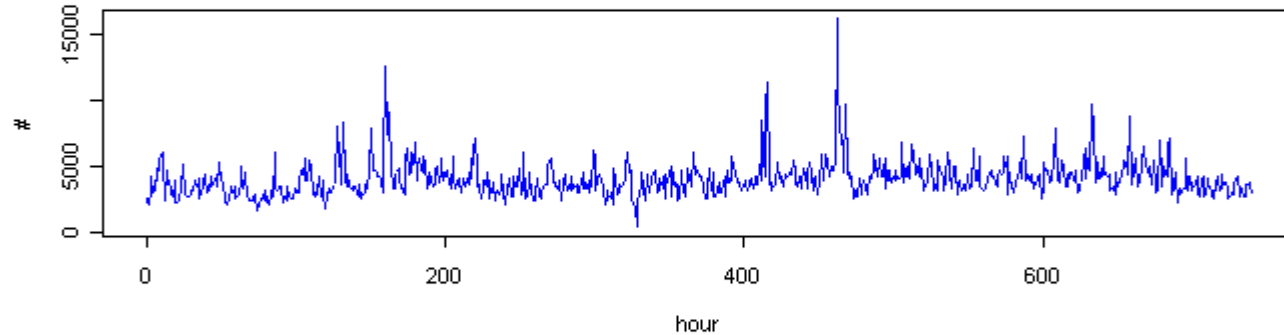
Cross Correlation



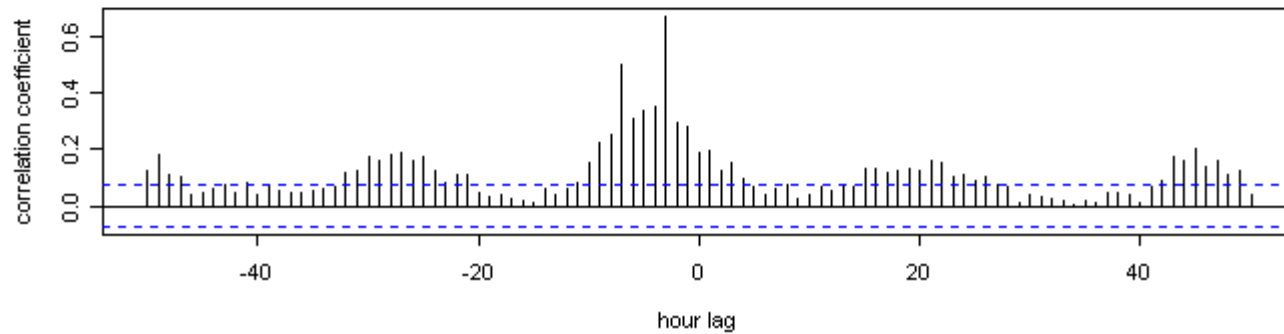
**Oregon Routeviews Hourly ASP changes
8/2002**



**RIPENCC Hourly ASP changes
8/2002**

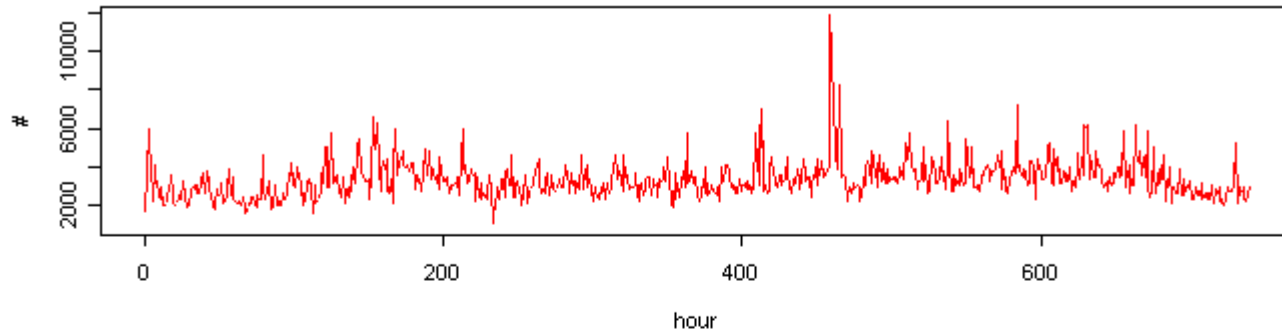


Cross Correlation



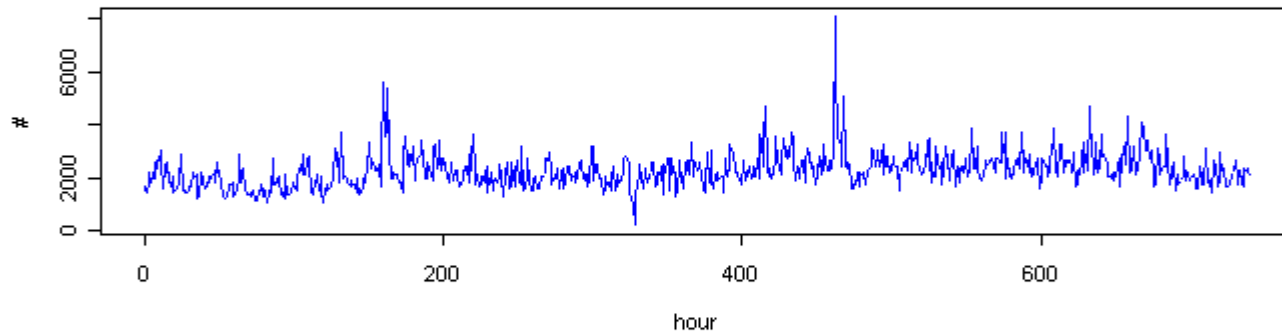
Oregon Routeviews Hourly COM changes

8/2002

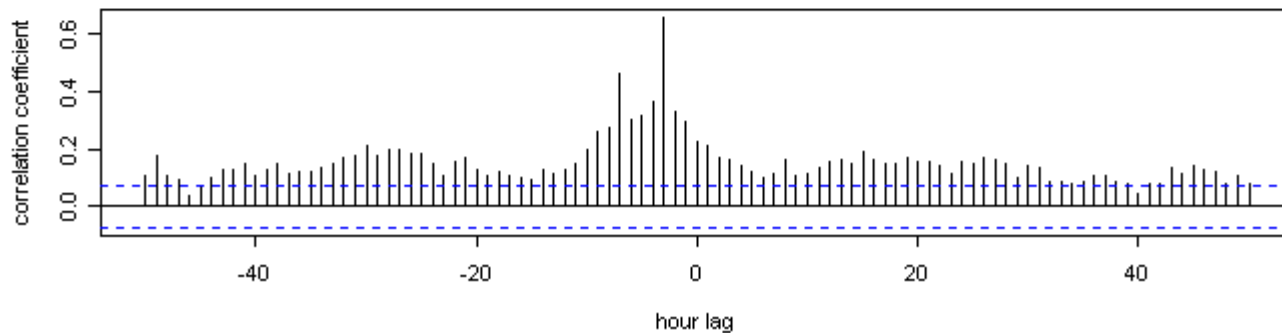


RIPENCC Hourly COM changes

8/2002



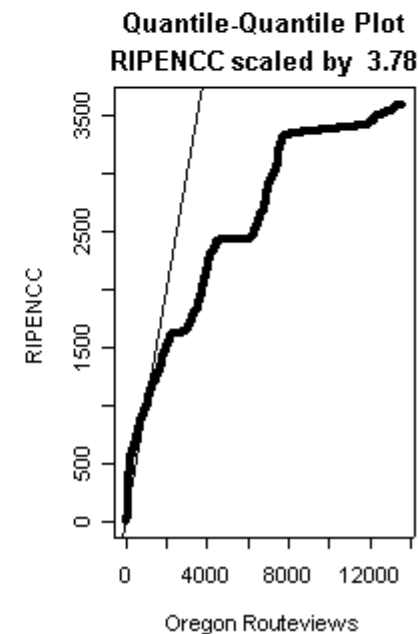
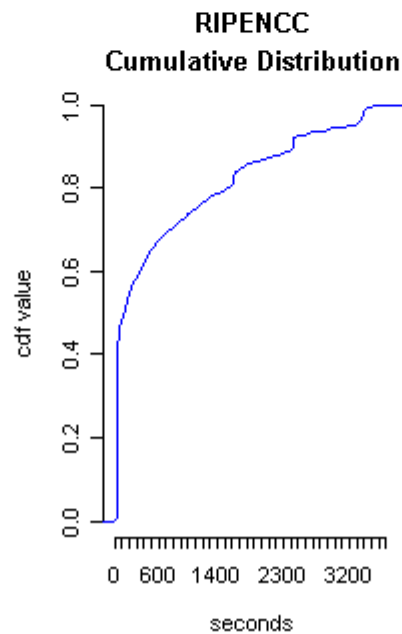
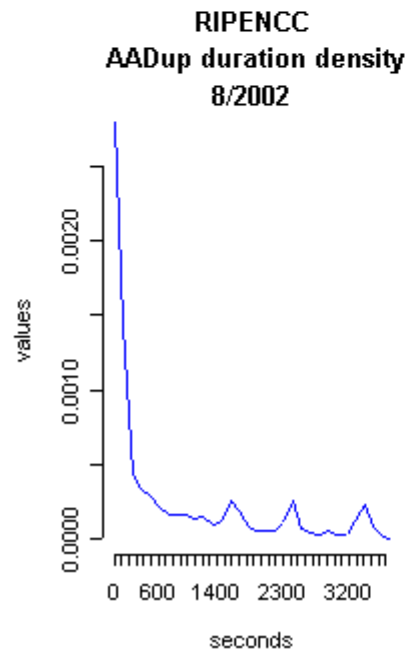
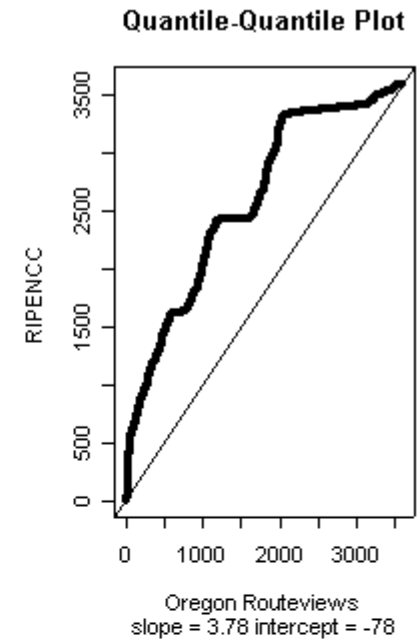
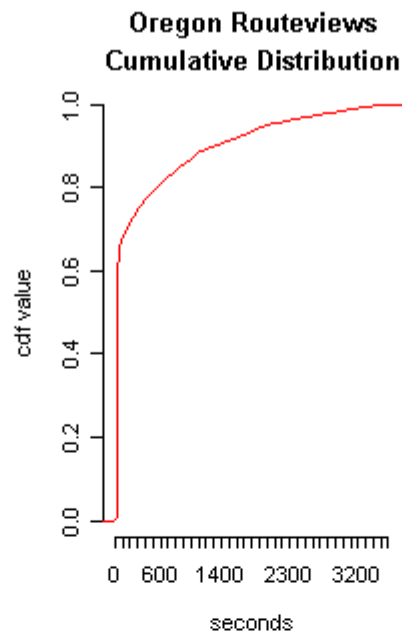
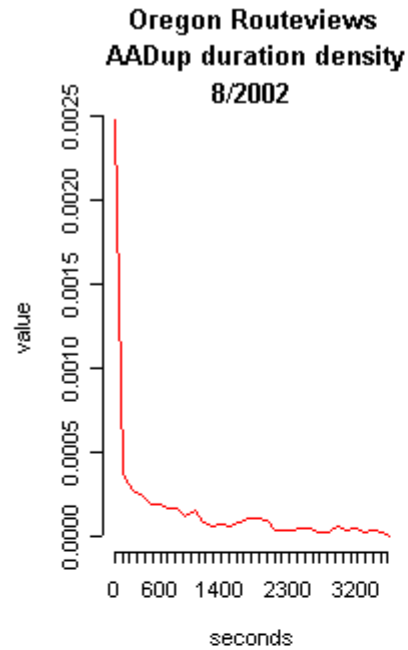
Cross Correlation

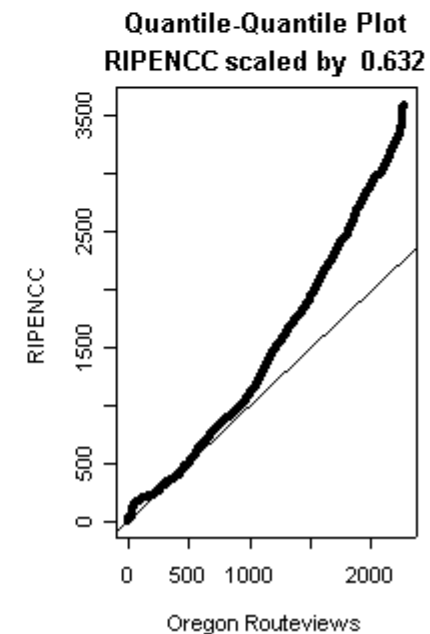
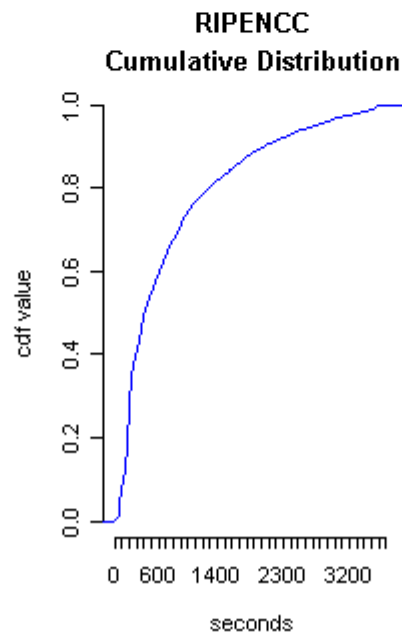
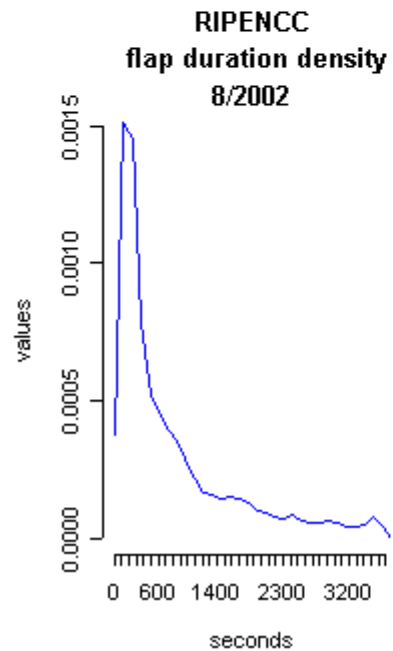
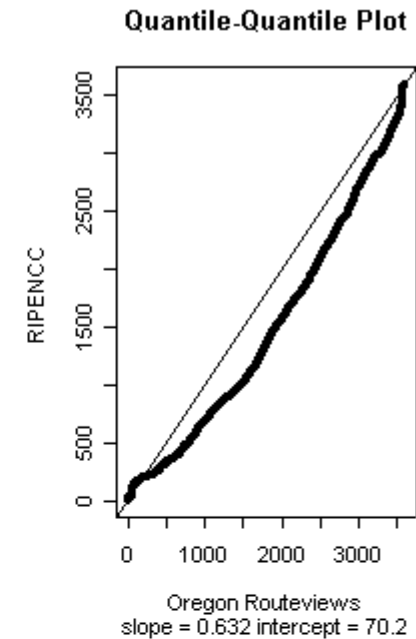
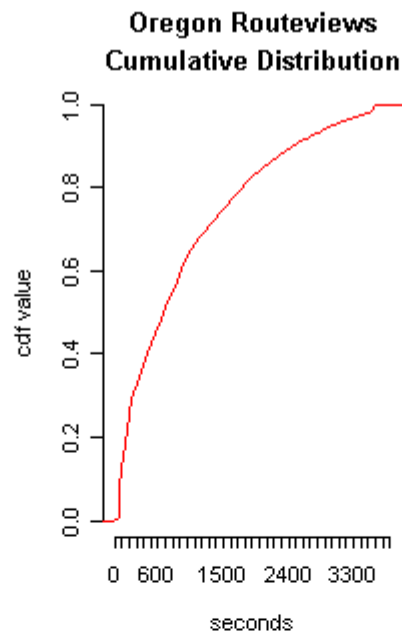
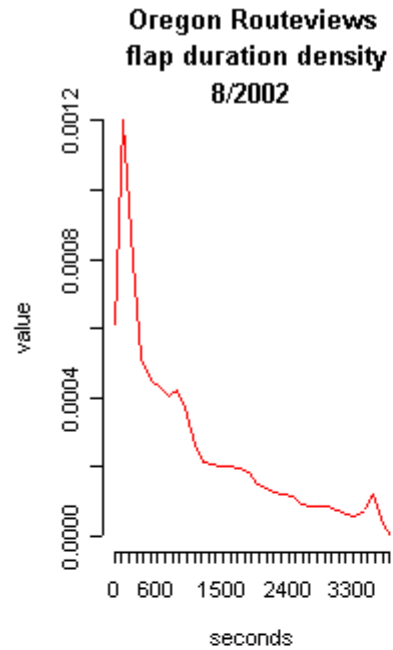


Conclusion III

- the distribution of AADup and flap durations are similar for Oregon Routeviews and RIPENCC within 70-80 percentile
- there is no clear relationship in the tail area







Next Steps

- **attempt to identify spatial and temporal patterns using defined measurements**
- **is there a baseline?**
- **develop methodology to quantify performance cost of BGP processing**



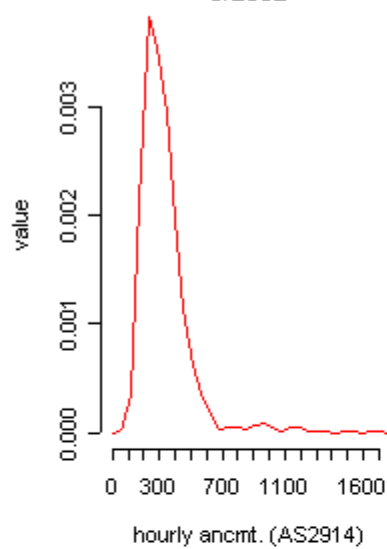
References

- [LA99] C. Labovitz, “Scalability of the Internet Backbone Routing Infrastructure”, Ph.D. Thesis, University of Michigan, 1999
- [WA02] L. Wang et. al., “Observation and Analysis of BGP Behavior under Stress”, Internet Measurement Workshop, 2002
- MRTd <http://www.mrtd.net/>
- R <http://www.r-project.org/>
- Density estimation
<http://www.maths.uwa.edu.au/~duongt/seminars/intro2kde/>
- Related work:
 - <http://www.icir.org/vern/imw-2002/imw2002-papers/217.ps.gz>
 - <http://www.sprintlabs.com/Department/IP-Interworking/Routing/PyRT/index.html>
 - <http://bgp.lcs.mit.edu/bgpview.cgi>
 - http://www.renesys.com/projects/bgp_instability/

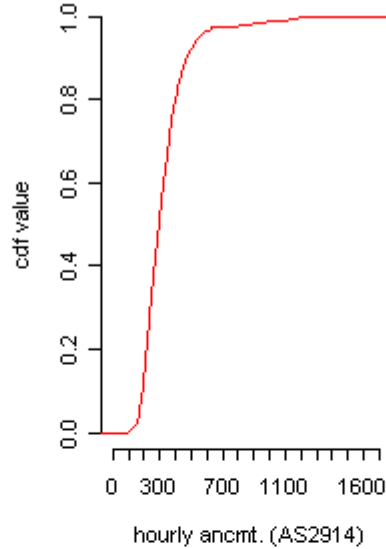
Credits

- **RIPENCC's RIS Team**
- **Oregon Routeviews**
- **Jonathan Li**

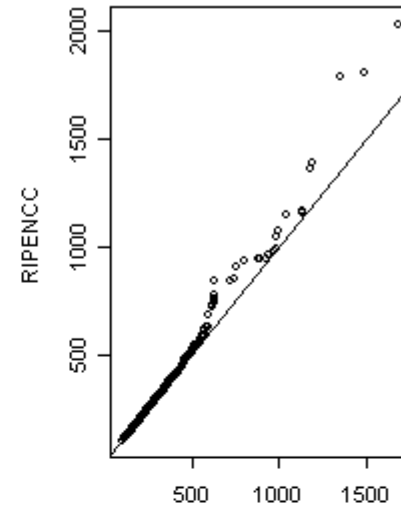
**Oregon Routeviews
hourly ancmt. (AS2914) density
8/2002**



**Oregon Routeviews
Cumulative Distribution**

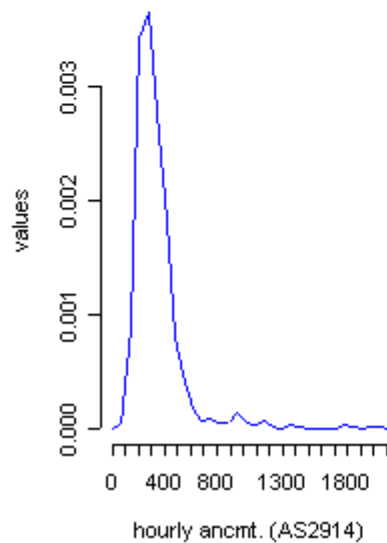


Quantile-Quantile Plot

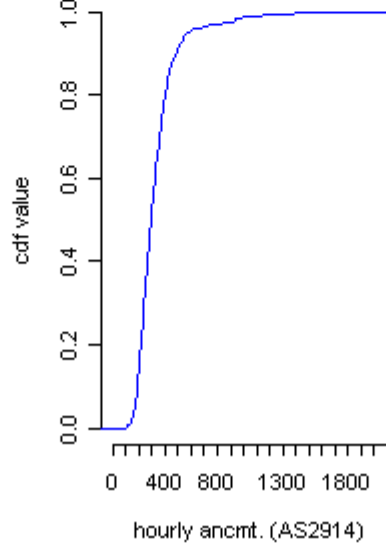


Oregon Routeviews
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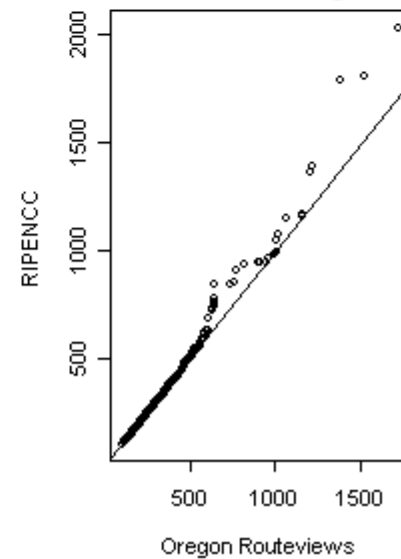
**RIPENCC
hourly ancmt. (AS2914) density
8/2002**



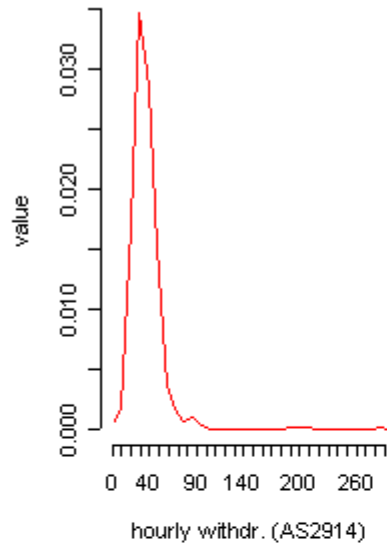
**RIPENCC
Cumulative Distribution**



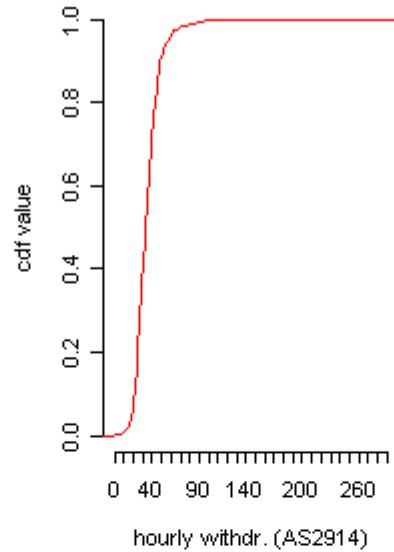
**Quantile-Quantile Plot
RIPENCC scaled by 1.02**



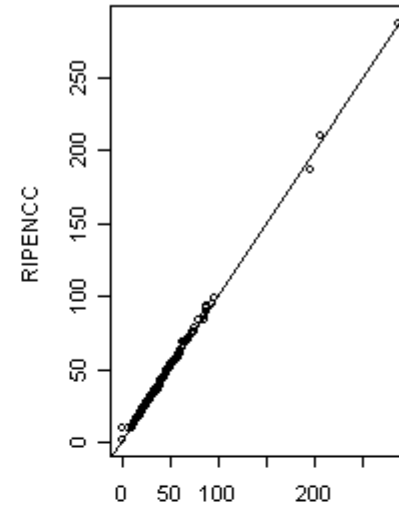
Oregon Routeviews
hourly withdr. (AS2914) density
8/2002



Oregon Routeviews
Cumulative Distribution

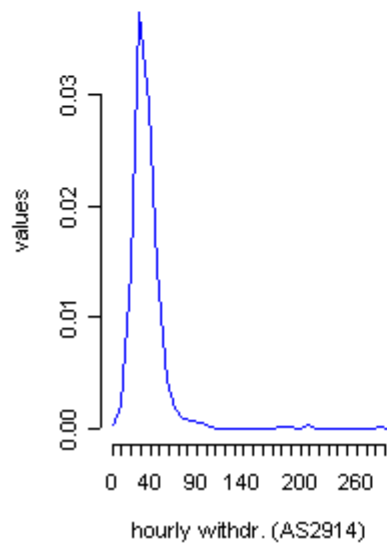


Quantile-Quantile Plot

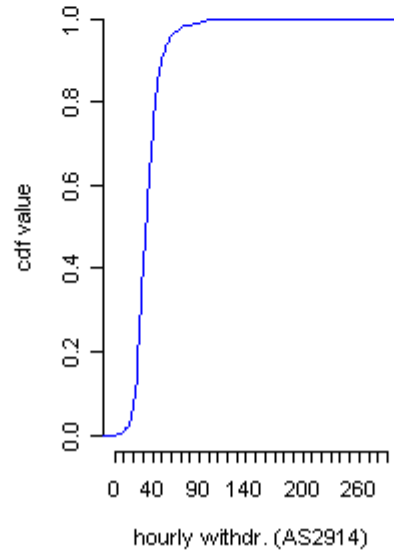


Oregon Routeviews
 slope = 0.933 intercept = 2.73

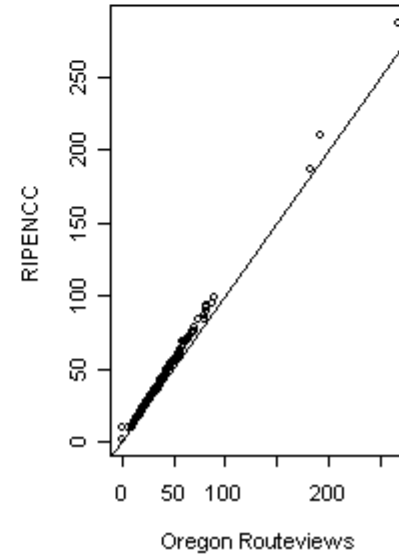
RIPENCC
hourly withdr. (AS2914) density
8/2002



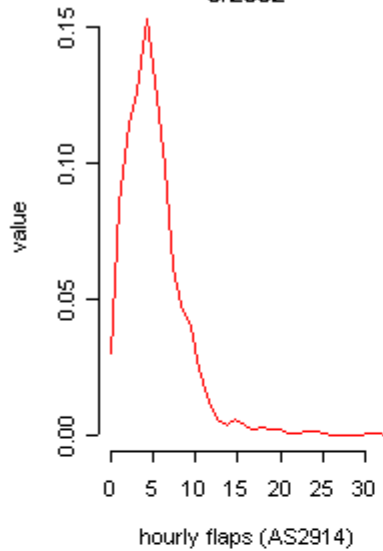
RIPENCC
Cumulative Distribution



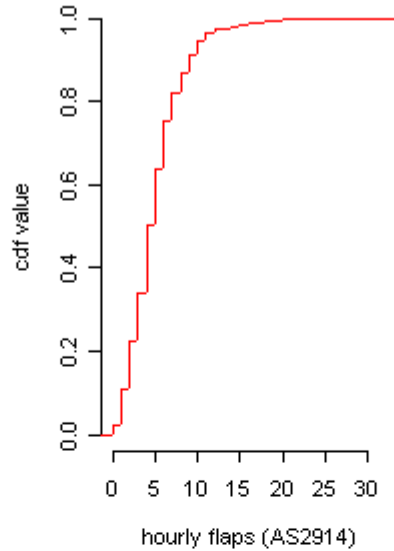
Quantile-Quantile Plot
RIPENCC scaled by 0.933



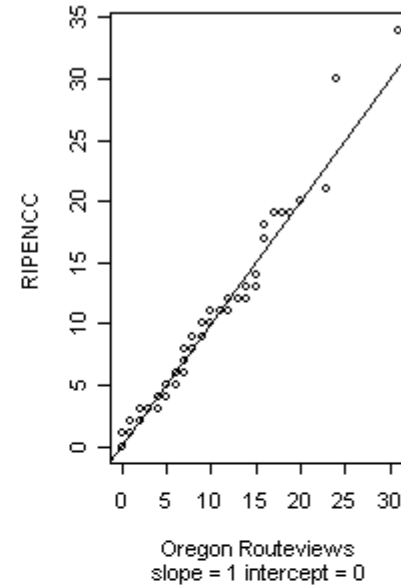
**Oregon Routeviews
hourly flaps (AS2914) density
8/2002**



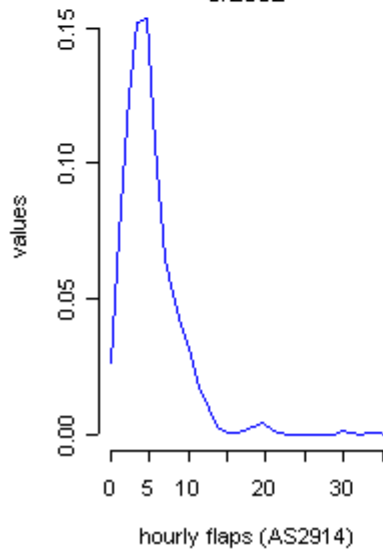
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Cumulative Distribution**



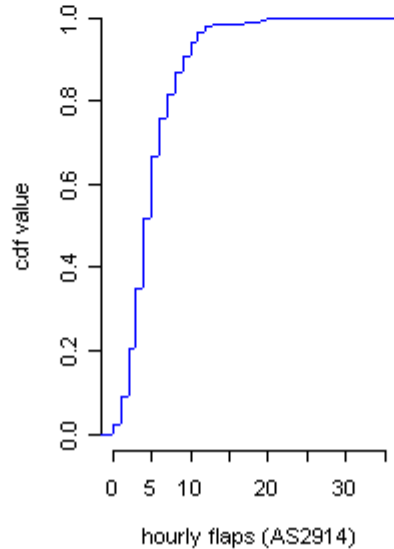
Quantile-Quantile Plot



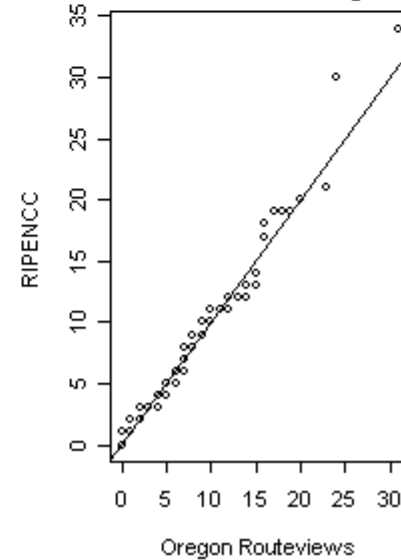
**RIPENCC
hourly flaps (AS2914) density
8/2002**



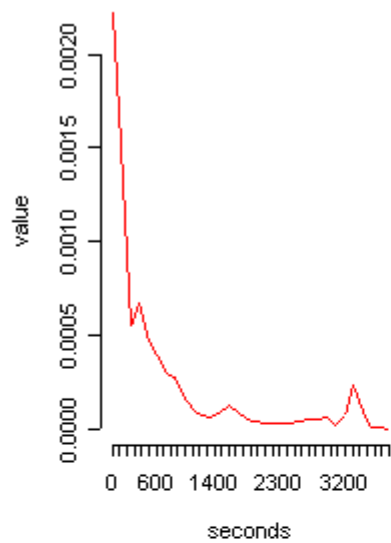
**RIPENCC
Cumulative Distribution**



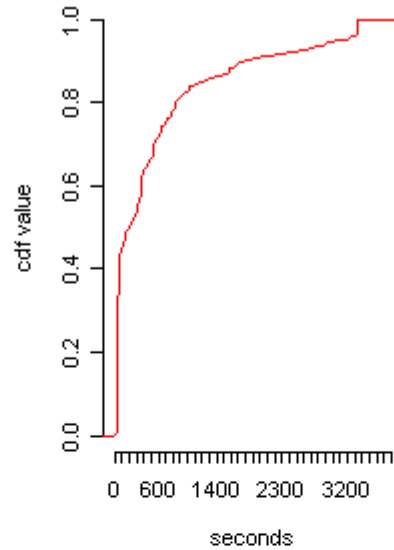
**Quantile-Quantile Plot
RIPENCC scaled by 1**



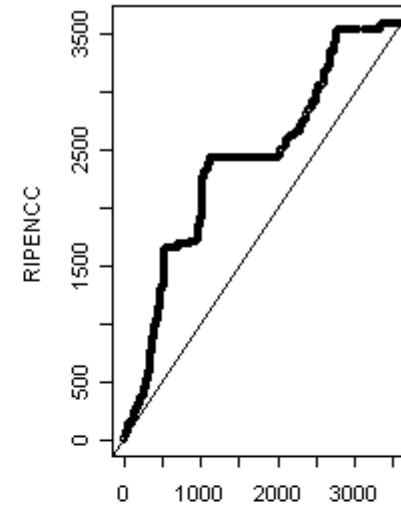
**Oregon Routeviews
AADup duration (AS2914) density
8/2002**



**Oregon Routeviews
Cumulative Distribution**

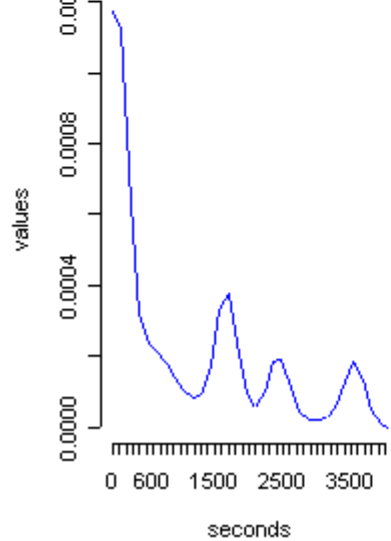


Quantile-Quantile Plot

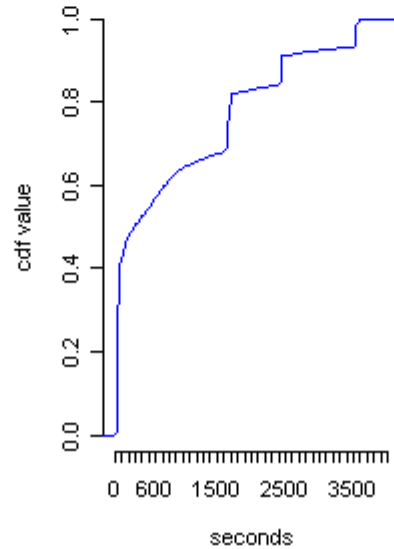


Oregon Routeviews
slope = 2.4 intercept = -40.7

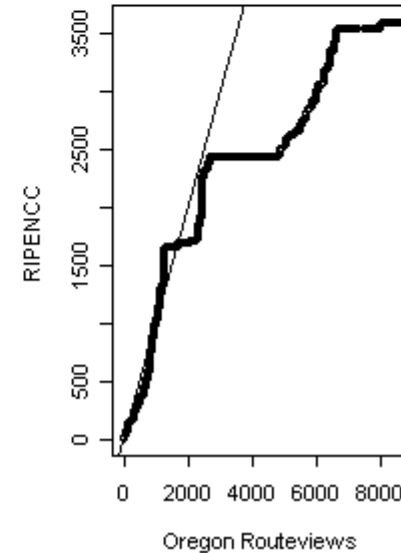
**RIPENCC
AADup duration (AS2914) density
8/2002**



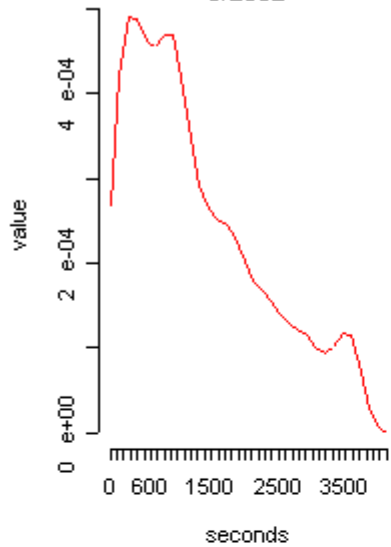
**RIPENCC
Cumulative Distribution**



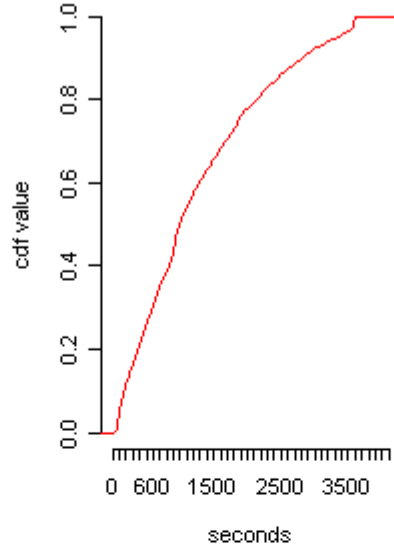
**Quantile-Quantile Plot
RIPENCC scaled by 2.4**



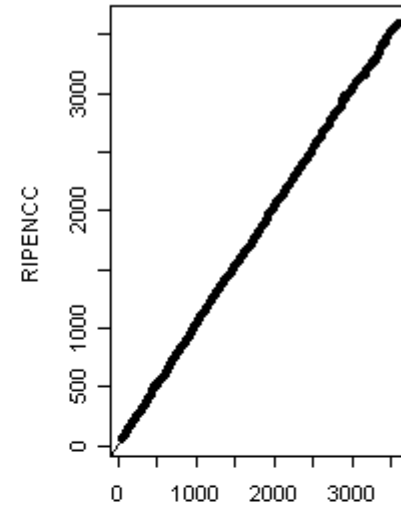
**Oregon Routeviews
flap duration (AS2914) density
8/2002**



**Oregon Routeviews
Cumulative Distribution**

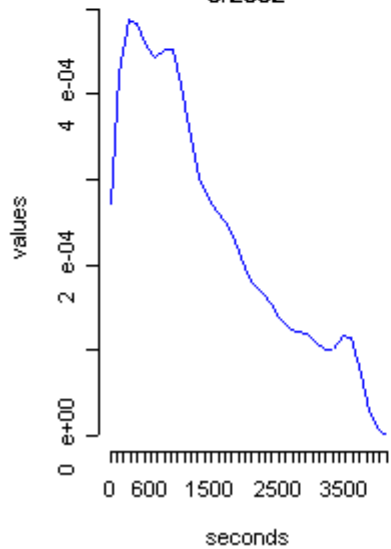


Quantile-Quantile Plot

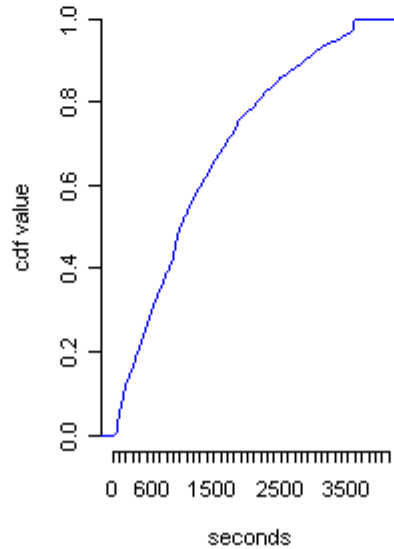


Oregon Routeviews
slope = 0.994 intercept = 4.06

**RIPENCC
flap duration (AS2914) density
8/2002**



**RIPENCC
Cumulative Distribution**



**Quantile-Quantile Plot
RIPENCC scaled by 0.994**

