

Self-similarity in voice group communications in trunked mobile telephony

Dimitrios G. Xenikos

Dept. of Humanities, National Technical Univ. of Athens

Hellenic Telecommunications Organization



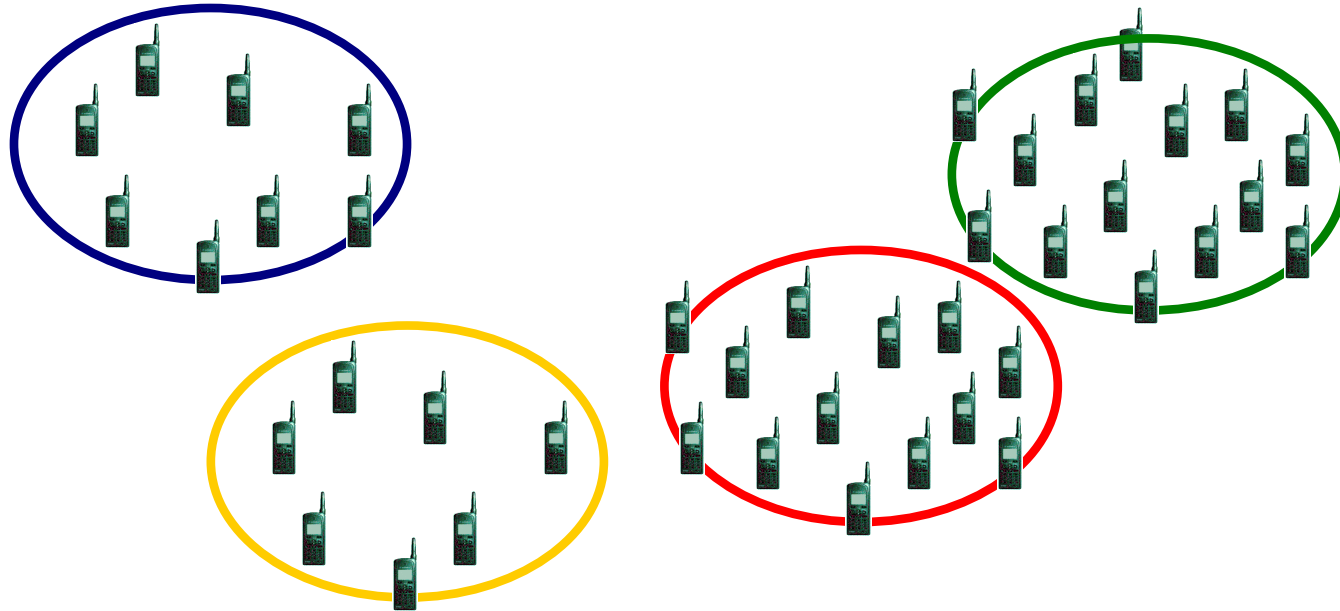
Trunked mobile telephony

(European Standard TETRA)

- Individual calls
- Group calls
 - Pre-defined groups
 - Dynamically defined groups
 - Calls from/to Dispatcher
 - Broadcast
- Emergency calls
- Calls to mobile and fixed telephony networks
- Data services



Predefined Groups



Telephony for groups of professionals

Thousands of groups are registered

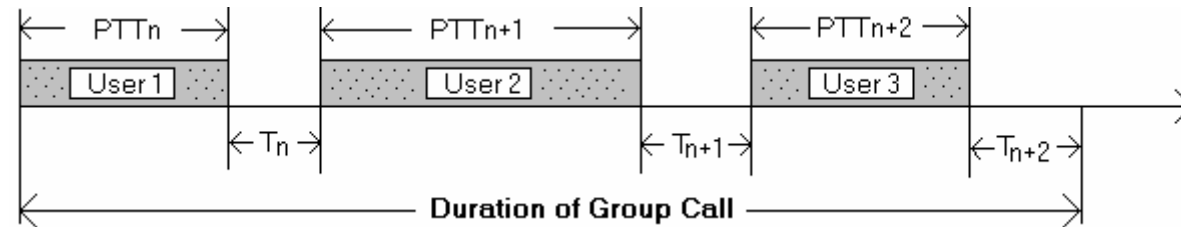
Each group has a few up to hundreds of members (typically ~15)

Group calls only among members of the same group



Group calls

“Push-To-Talk”
PTT button

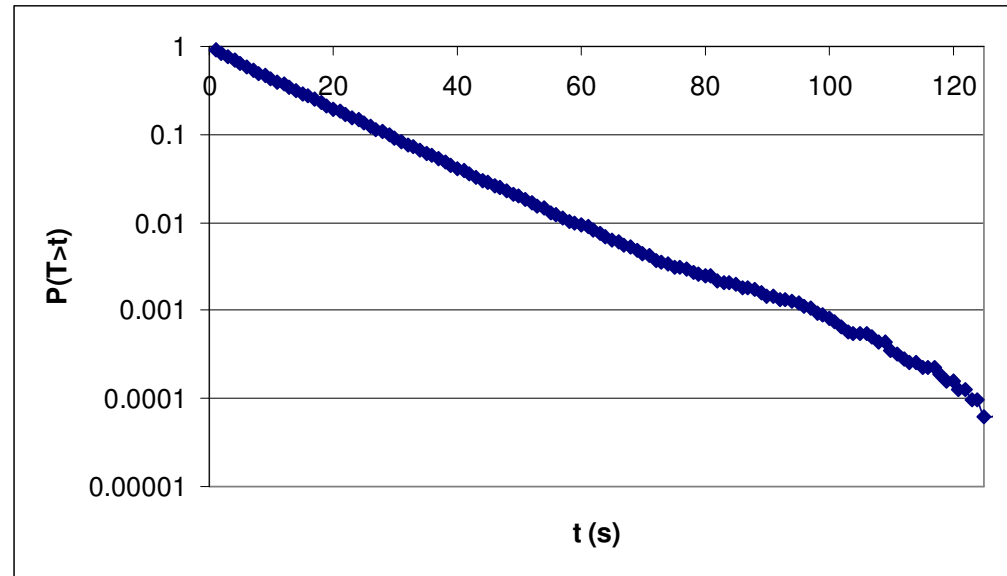


- Group call is a short dialogue session
- One presses PTT and everybody in the group listens
- Call Duration = sum of PTTs and intervening times

- Typical PTT is 5 sec
- Intervening time < 3sec



Inter-arrival times (between group calls)

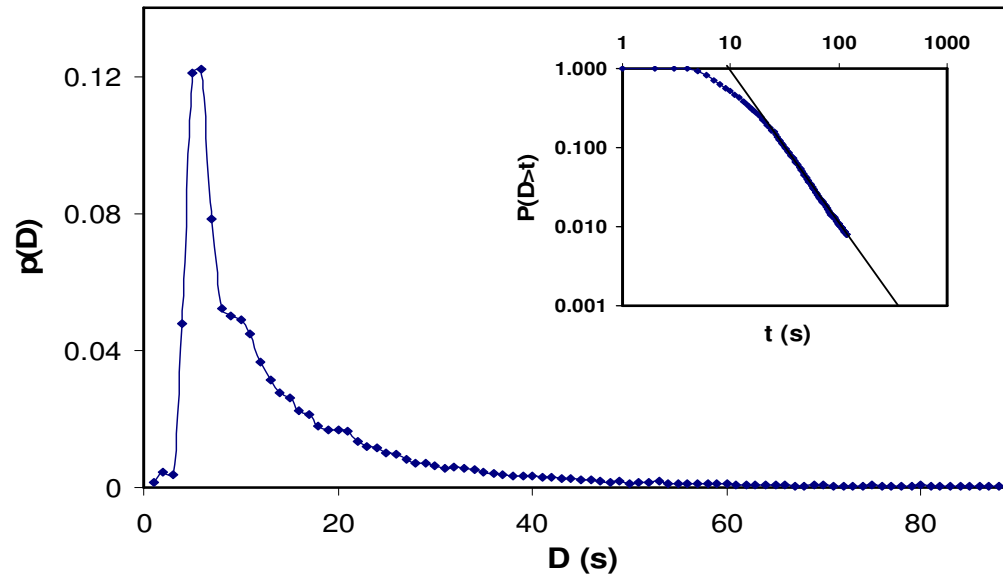


Inter-arrival times (between group calls) decrease almost exponentially

As expected in **uncorrelated** events



Call duration times



Call Duration times decrease with $P(D > t) \sim t^{-\alpha}$, $\alpha = 1.8 \pm 0.2$

$\alpha < 2$ suggests that the group call time series is self similar

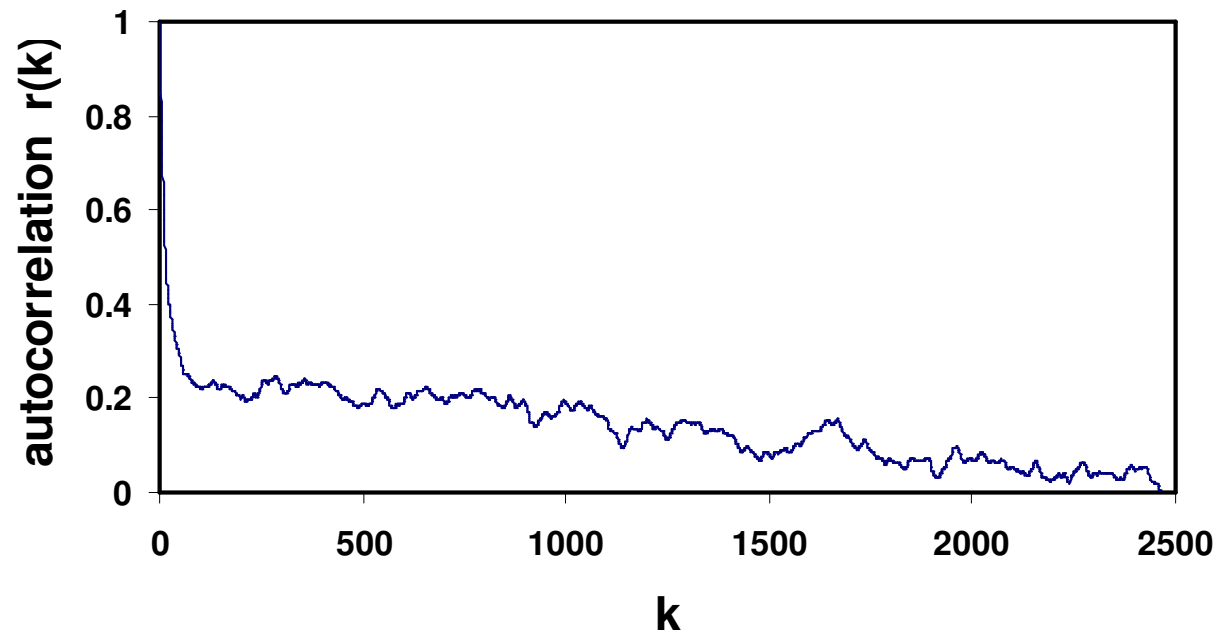
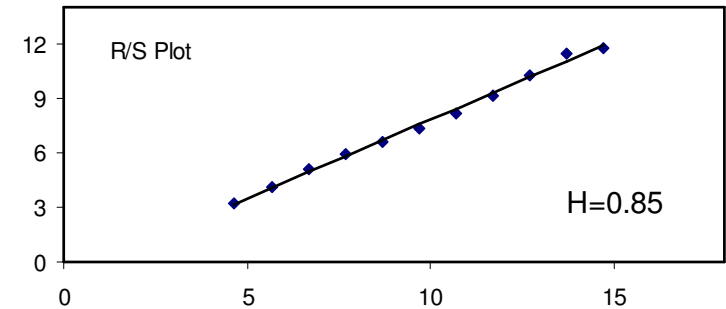
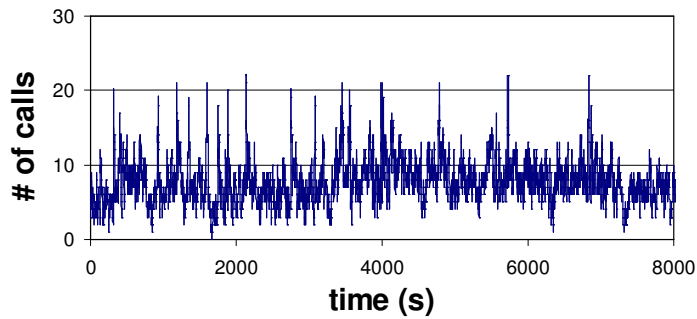
(Mandelbrot) Sources with two states ON & OFF

If the distributions of ON or OFF are heavy tailed (with a_1 and a_2)

The aggregation of sources gives Self-similar time series, $H = (3 - \min\{a_1, a_2\})/2$



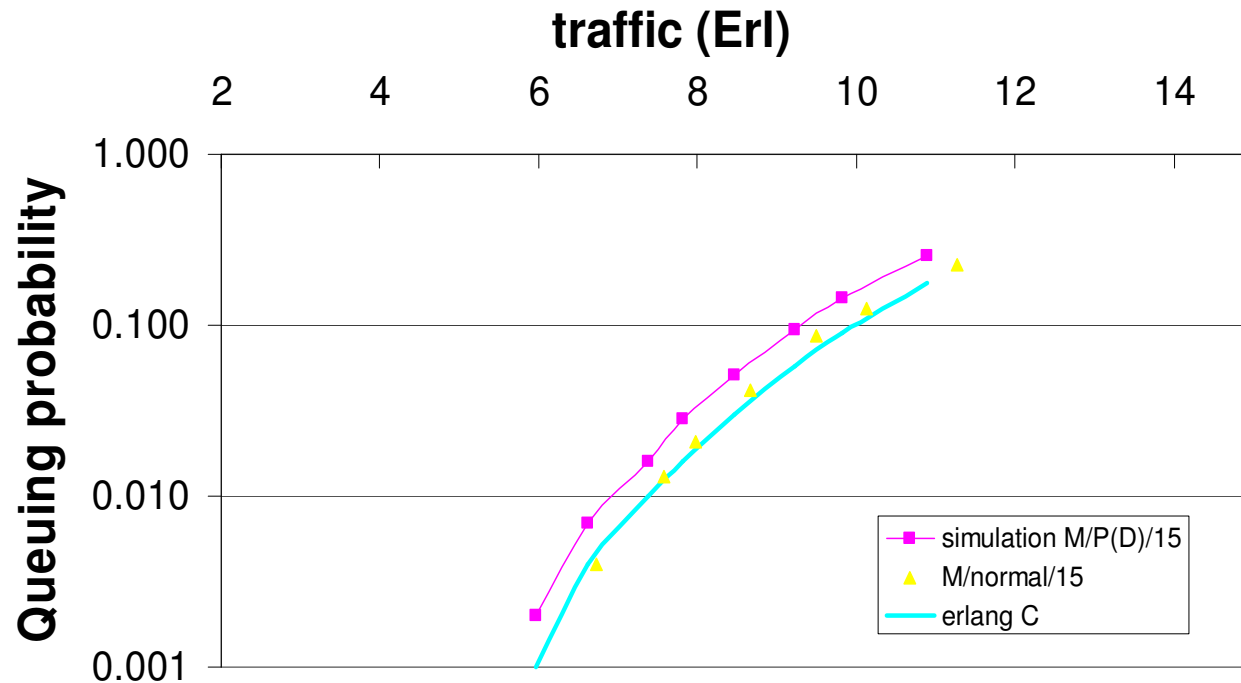
Group call correlations



Group calls are strongly correlated - Evidence for self-similarity



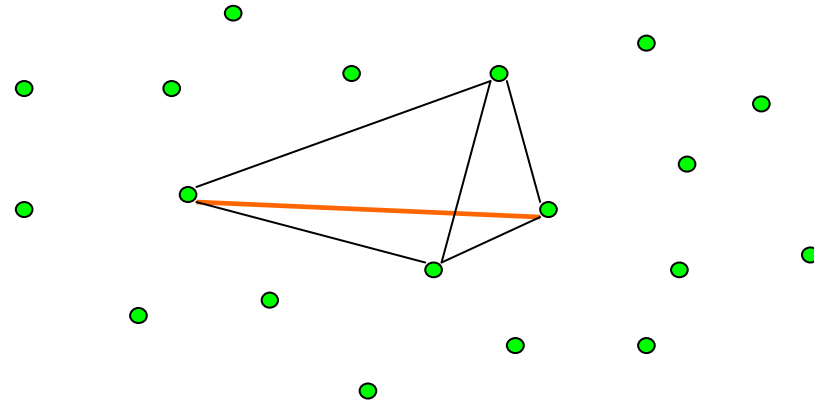
Consequences – telecommunications traffic



Queuing probability is much larger than the Erlang C predictions



Social correlation and call duration



Calls are initiated randomly but have a heavy tail distribution for call duration
→Social correlations and social morphology are inherent in the length of the dialogue

Why do people talk longer than expected?

Discussion indicates how weak links stabilize the group interaction

On serious issues, the presence of weak links demands ways to
establish trust
discuss various options
coordinate activity...



Social structure and conversation

Conventional approach: Conversation is a **result** of the social structure

Conversation analysts +ethnomethodologists (studies of content):

The strength of social links is not prearranged

Social structure **emerges** spontaneously in conversation

(formal/ small talk, pattern of questions/answers/interruptions,...)

→Our data show how weak links are established in professional environments

Also, conversation is concurrent with action (technical problems, security issues, administrative practice...) – **acting on an issue resembles talking about the issue**

→Our data can show how weak links are established through social activity

It would be interesting to see the generation of social morphology in conversations that **imply action only indirectly** (broadcast mass media –TV, newspapers, etc)

