Introduction by Paul Spirakis

1. What is Complexity ?

It is understood as : Computational , Emerging .

(Computer Science , Physics)

It is hard to control : (complicated nets , myriads of interactions).

It has a dynamic character also (fast changes in huge structures ,

also failures . Updates may "move" slower than rate of changes...)

It can appear in "random" cases (Can it really ? eg SAT).

2. What is Autonomicity ?

It is a word of Greek origin . It litterally translates to "self-lawed"

and in modern Greek almost to "anarchy".

For networks people it means all the "self-*" properties :

E.g. self managed , self configured , self healing , self organised , self improving ...

This also includes "selfishness" and thus antagonism.

It is perceived to presume a local "intelligence " of some degree.

Can be studied at a components level (Hardware...) , or a System level.

3. Comparing the terms

Complexity is a problem and a property. It is easy to "see" and hard to understand.

Autonomicity is a method and a property. It might be an answer to Complexity

or it may create worse problems (chaos , anarchy ...)

4. Why look at autonomic systems design ?

a. Large systems disallow global control.

b. Central management impossible .

c. Examples that work nice are the market , the society , animal groups...

d. Evolution helps an autonomic system.

e. May start from simple principles.

5. Some questions :

a. Do we really attempt to hide some problems via autonomicity "magic " ?

b. How far does self-* become implementable ?

c. Can we really design/derive self-improving code and get rid of software designers ?

d. How can we verify the correctness of a self-* implementation of a property ?

6. Distributed Computing

a. Its foundations have many resemblances with autonomicity goals.

E.g. Dijkstra's self-stabilizing code ...

We see there local protocols , and communication to achieve global goals.

E.g. Leader election protocols , Byzantine agreement.

Also , many impossibility results (a la FLP) indicate that not everything is

possible.

Is modern distributed computing the same as autonomicity , just renamed ?

7. The beautiful theory of evolution under antagonism.

a. Evolutionary game theory, very precise mathematically and new.

b. Individuals there "learn" or even copy better behaviours of others.

c. The theory there connects "dynamics" and structure in a beautiful way.

d. Global equilibria and ways to argue about them (Potential Theory).

8. A new (also old) way to control Complex Systems.

a. Think about traffic lights , also taxes , also advertisement.

b. They motivate locals for "better" global behaviour.

c. Perhaps a new way of programming (Catalytic Programming).

9. Approaches to study Complex Systems

a. Via maths of local interactions , from Physics.

b. Via emerging nets/structures/behaviour theories.

c. Via evolutionary processes.

We donot understand well how to model/control the time varying

aspects ... (dynamic control theory is old and very centralised ...)

10. Do we have a radical change in Telecom research ?

a. How about standards ?

b. What are measures of quality of service in autonomic systems ?

c. Can we convince that autonomic protocols are "stable " ?

Think e.g about BGP

d. Is it an "interfaces" science ?

Are we looking for a "glou" that connects all , and minimizing the

enforcement paradigms ?

Are we opening a "Pandora Box" in Telecom research ?

e. Is the Internet and the Web the cause of all this ?
