A Computing Roadmap of Digital Ecosystems

From metaphor towards paradigm

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Digital Ecosystems

Metaphor: "*A figure of speech in which a word or phrase is applied to an object or action to which it is not literally applicable.*", Oxford Dictionary
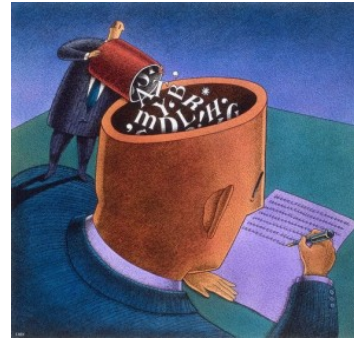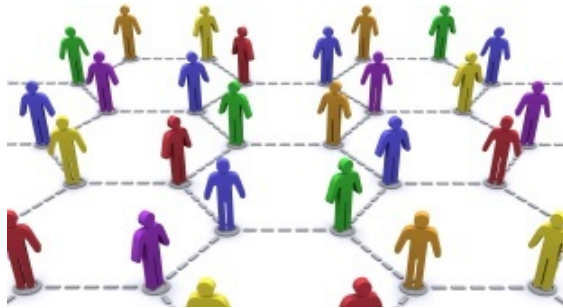
Digital Ecosystems

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Focus: Computing areas and their interventions

Roadmap?

Paradigm: "*A world view underlying the theories and methodology of a particular scientific subject.*", Oxford Dictionary
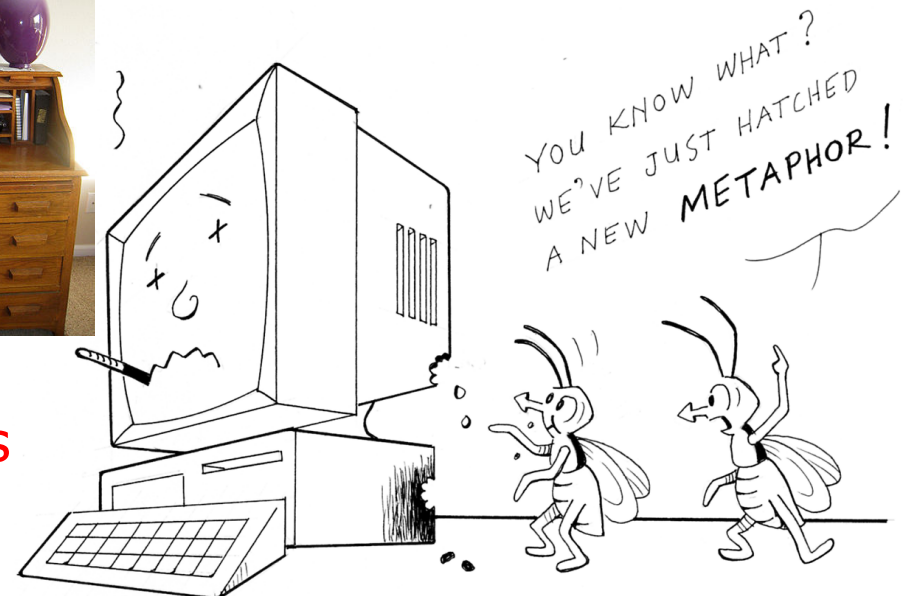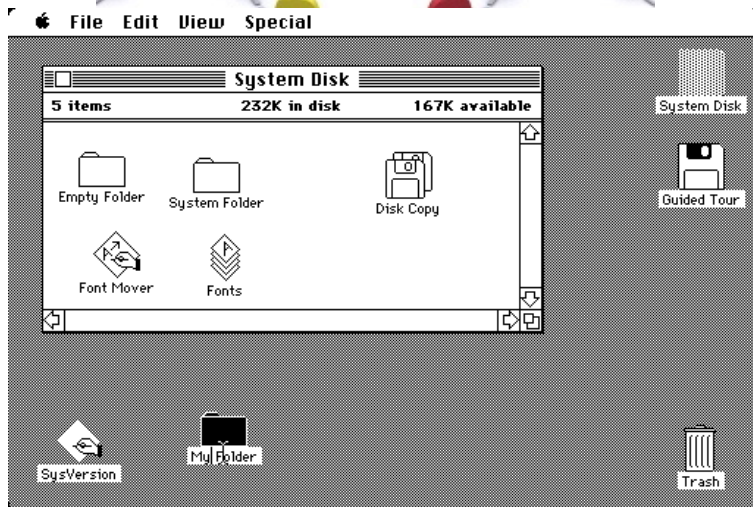
Metaphors

Inspiration

Intuition

Educational value

Multidisciplinary concepts

Oversimplifications

Misconceptions
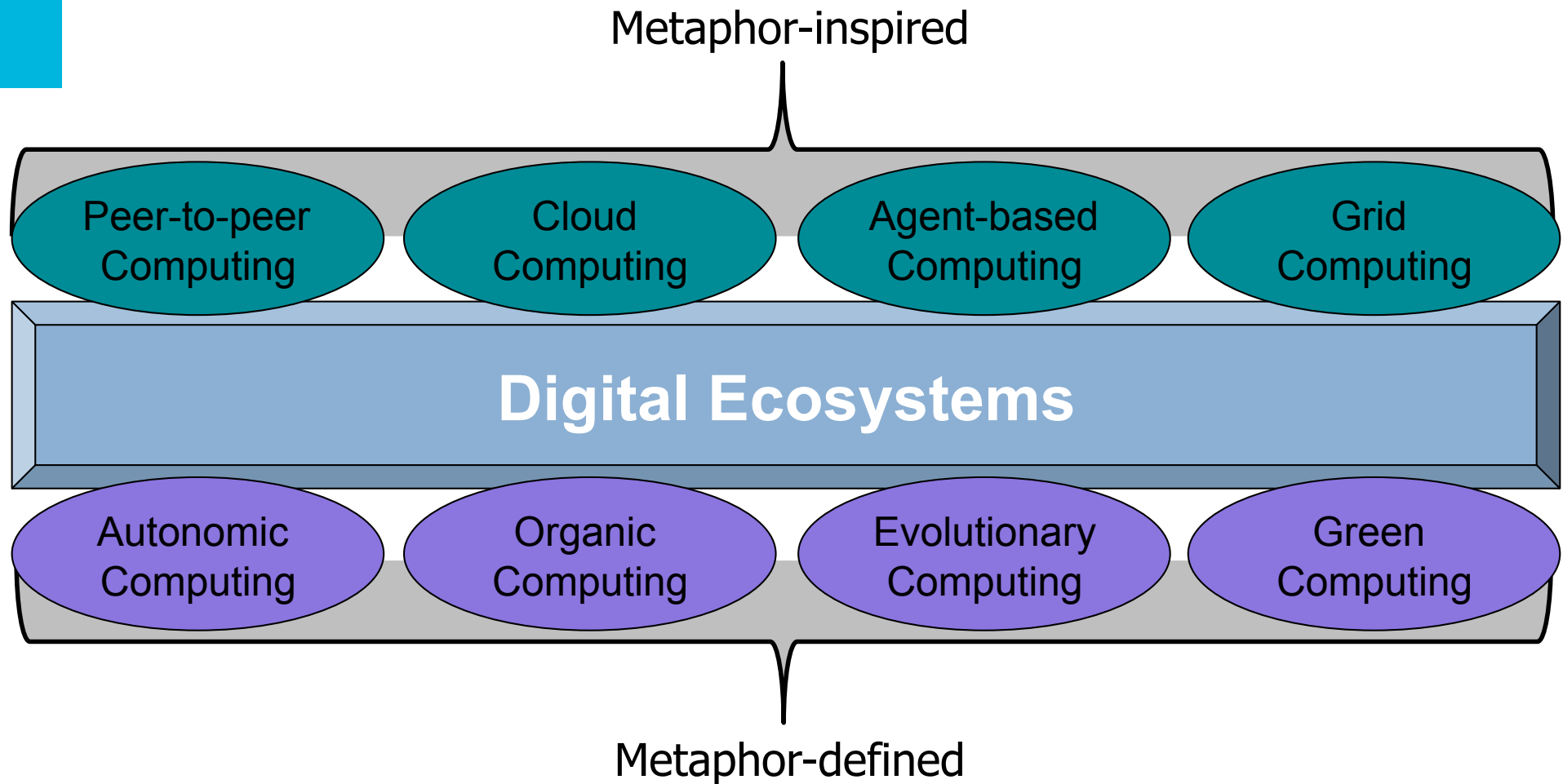
Conceptual problems

Metaphors (Cont.)

How are metaphors used in **computing areas** of digital ecosystems?

Computing Areas

Metaphor-inspired

| Peer-to-peer Computing | Cloud Computing | Agent-based Computing | Grid Computing |

Digital Ecosystems

| Autonomic Computing | Organic Computing | Evolutionary Computing | Green Computing |

Metaphor-defined

Computing Interventions

Cloud Computing

Agent-based Computing

Network architectures

Peer-to-peer Computing

Software architectures

Grid Computing

System optimization

Resource virtualization

Energy efficiency

Autonomic Computing

Green Computing

Environmental sustainability

Organic Computing

Evolutionary Computing

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Current Practice

Multidisciplinary research

A wide range of applications

Impact on different socio-technical and business domains

Overlap in concepts, contributions and interventions

Limited awareness and coordination

Roadmap

Metaphor

Digital Ecosystems

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Paradigm

5 propositions!

Proposition #1

Digital ecosystems are more (and less) than biological ecosystems.

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Proposition #2

Digital ecosystems require both metaphor-inspired and metaphor-defined computing areas.

Proposition #3

There is a major overlap in the concepts, objectives, contributions and interventions of computing areas of digital ecosystems.

Proposition #4

Digital ecosystems require a self-awareness and coordination of computing contributions and interventions.

Proposition #4 - Example

Green Computing: *Which types of machines are required?*

P2P Computing: *How important is decentralization and P2P communication?*

Organic Computing: *How can the system self-organize its interactions?*

Autonomic Computing: *Is software able to self-manage trade-offs between performance, energy consumption and carbon footprints?*

Design of an efficient and environmental-friendly data center

Grid Computing: *Which methods can be applied for the computation of these trade-offs?*

Agent-based Computing: *Which software models realize these methods?*

Evolutionary Computing: *Are the achieved solutions optimum?*

Cloud Computing: *How does the user access the services of such a data center?*

Proposition #5

Digital ecosystems can potentially become a collaborative research environment or platform of computing areas.

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Conclusions and Challenges

Computing areas of digital ecosystems use metaphors in different ways

The use of effective metaphors in digital ecosystems is challenging

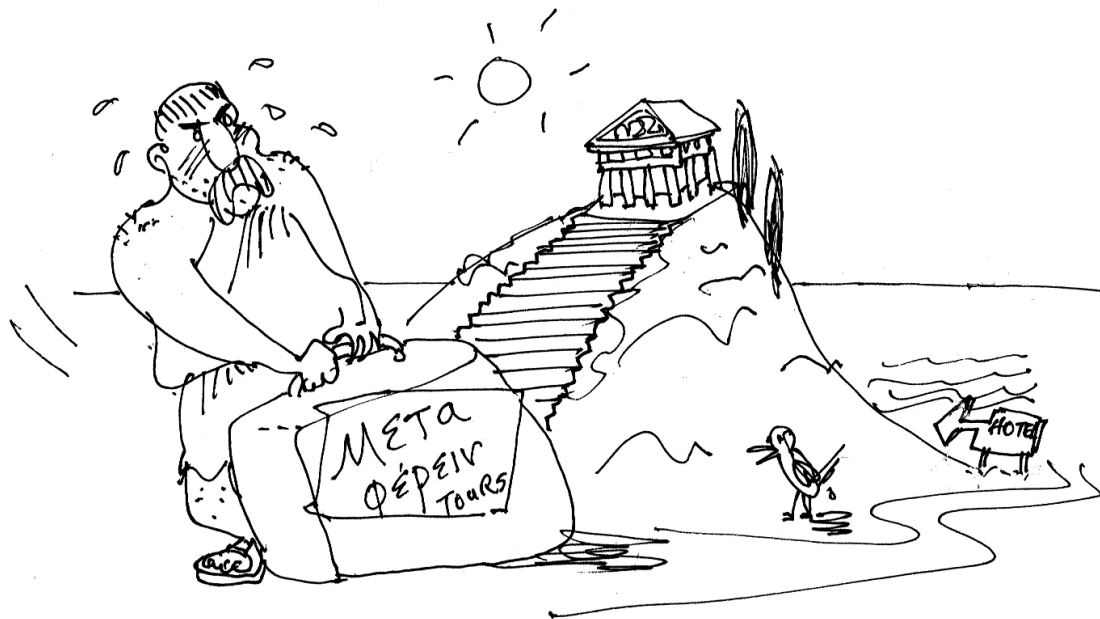Awareness and coordination are required

A **collaborative research environment** towards the **digital ecosystem paradigm** is promising

Questions?

More information

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