

# Services for Context Prediction and Proactive Adaptation in Ad-Hoc Environments

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- Context prediction
- Act-Ahead-Adaptation
- > Architecture
- Research challenges

AFRL W/S "*Research Directions in Situational-aware Self-managed Proactive Computing in Wireless Adhoc Networks*", Kansas City, 23 May, 2010

# Context prediction

- Sequence prediction
- Markov chains
- Bayesian networks
- Neural networks
- Branch prediction
- Trajectory prolongation
- Expert systems



Context Sensing time triggered or event triggered acquisition of low level context information

Context Transformation aggregation / interpretation of low level context information

Context Representation data structures representing abstract context information

Context Forecasting

Context Rule Base implicit or explicit triggering of control events

Actuators control the environment

# Context prediction & proactive adaptation



#### **CALCHAS** Architecture



## Adaptation Engine



### Features & Challenges of Proactive Adaptation

- > Uncertainty & dealing with probabilities
- Continuous action spaces
- > Continuous state spaces
- Mobility of nodes
- > High dimensionality of context
- Lack of context quality metrics
- > High heterogeneity of data
- > Lack of ability to incorporate prior knowledge
- > The need for explicit prediction result & above the threshold
- Limited exploration capabilities
- > Limited time for decision making
- > User objectives change ad hoc and require meaningful prompt support