Context-Awareness
Definition of Context

- **Context by Schiilt, Adams, Want (Intel Research)**
  - Three important aspects of context are
    - Where you are,
    - Who you are with, and
    - What resources are nearby
  - Context-aware systems adapt according to the location of use, the collection of nearby people, hosts, and accessible devices, as well as the changes to such things over time. A system with these capabilities can examine the computing environment and react to changes in the environment.

- **Context by Dey (Georgia Tech)**
  - Context is any information that can be used to characterize the situation of an entity. An entity is a person, place, or object that is considered relevant to the interaction between a user and an application, including the user and applications themselves.
  - A system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user's task.

- **Context by Chen, Kots (Georgia Tech)**
  - Context is the set of environmental states and settings that either determine an application's behavior or in which an application event occurs and is interesting to the user.
  - Active context awareness: an application automatically adapts to discovered context, by changing the application's behavior.
  - Passive context awareness: an application presents the new or updated context to an interested user or makes the context persistent for the user to retrieve later.
Reasons to be Context Aware

- **Functional**
  - Context-specific services and applications
    - Position of persons and things
    - Selection and filtering information

- **Non Functional**
  - Overcome limitations
    - Restricted user interface
    - Limited resources
Context Types and Sources

- Computing Context (applications)
  - Network connection
  - Communication costs
  - Nearby resources (displays, printers)
- User Context (profiles)
  - User’s profile
  - Location
  - People nearby
  - Current activity
- Physical Context (sensors)
  - Lighting
  - Noise level
  - Traffic Condition
Context-aware applications

- **Active context**
  - Presentation of information and services to a user
  - Selection of services or information for a user
  - Automatic execution of services for a user

- **Passive context**
  - Tagging of context to information for later retrieval
Examples - Presentation

- **Navigation**
  - Find a route from A to B
  - Dynamic information (traffic jams, detours)

- **Location-based services**
  - Present interesting targets (restaurants, printers, friends)

- **Multi-modal interfaces**
  - Changing HCI depending on
    - Velocity
    - Device properties
    - User preferences (visually impaired)
Examples - Selection

- Select the next printer
- Booking and reservation systems
  - Account for user preferences (e.g. non-smoking)
- Navigation systems
  - Context-dependent restriction (avoid stairs for people in wheelchair)
  - User preferences (prefer elevators instead of stairs)
  - Dynamic information (traffic jams)
Example - Execution

- **Ambient intelligence**
  - Physical environments react to user profiles
  - Lighting, heating
  - Background music

- **Teleporting**
  - User interface follow user

- **Spatial events**
  - Actions triggered by events in the physical world
    - Notify if within reach
    - Act on meeting
    - Enter, leave building
Examples - Tagging

- Audio and video recording
  - Add time information
  - Add position information (photos)
- Spatial Reminder
  - Post-it notes
  - Active badges
Why models?

- A system is context-aware if it uses context to provide relevant information and/or services to the user, where relevancy depends on the user task
  - How to retrieve context?
  - How to represent context?
  - How to store and manage context?
  - How to access context from the application?
  - How to share context among applications?

- Middleware!!!!
A Generic Context Model and Middleware
Context Model and Middleware

- Application Specific Context
  - Legacy solutions
  - Easy to develop applications
- General purpose context
  - Standardized description of context
  - Complex algorithms to understand context
- Event-based VS. Query
Cool Example (Human Dynamics Group – MIT Media Lab)

- Inferring Context from people interactions:
  - Who is taking with who?
  - Inferring social networks?