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From Discovery to Innovation...

Communications Psychology: Four Useful Concepts

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Council Canada

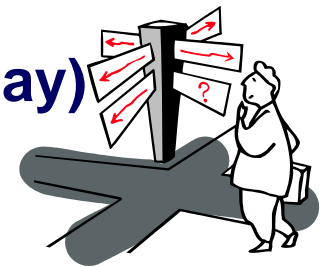
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Concept 1: QoS versus QoE

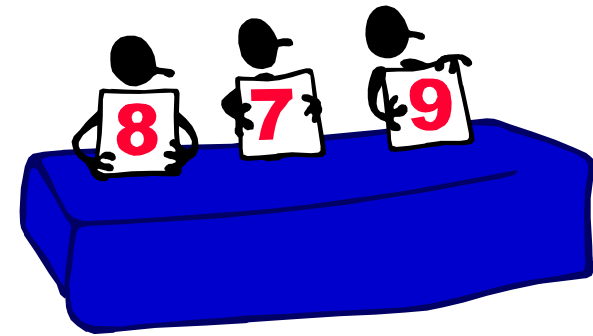
- developed with Ben Bauer

- the term **“Quality of Service”** (QoS) is used in many ways
 - the desired service quality (“carrier grade”)
 - the service quality as perceived by the user (“excellent”, “acceptable”)
 - the desired quality of data transmission (“gold”, “expedited”)
 - the actual quality of data transmission (errors, delay)
 - various mechanisms to tag data packets for special handling (DiffServ, RSVP, MPLS)



The Proposal

- reserve “QoS” to describe mechanisms for tagging packets
- use the term “**Quality of Experience**” (QoE) to describe the quality as perceived (experienced) by the user
 - e.g., Web QoE Workgroup
- use the term “Grade of Service” to refer to the desired service quality
- **Goal: make a clear distinction between user quality and network/system quality**



QoE: Quality of Experience

“The characteristics of the sensations, perceptions, and opinions of people as they interact with their environments”

- Measure of human experience, not technology
- The “touchy-feely” part of technology
 - Pleasing and enjoyable **VERSUS** displeasing and frustrating
- *User satisfaction requires a good experience!*



http://www.castrovalleyrotary.org/Minutes/February2003/February25/petting_zoo.jpg

Characteristics of QoE

- **QoE is not QoS**

- **QoS**: technical approaches to improve data flow
 - Diffserv, RSVP, MPLS
- **QoT**: characteristics of the data flow
 - Throughput, packet loss, latency, jitter
- Goal is to maximize QoE
 - **Need to understand QoE to use QoS and QoT effectively**
 - **Good QoS \Rightarrow good QoT \Rightarrow good QoE**

- **QoE-drivers are different for different tasks**

- Task: Streamed audio lecture
 - Fidelity is most important for QoE
- Task: Interactive business meeting
 - Latency is most important for QoE

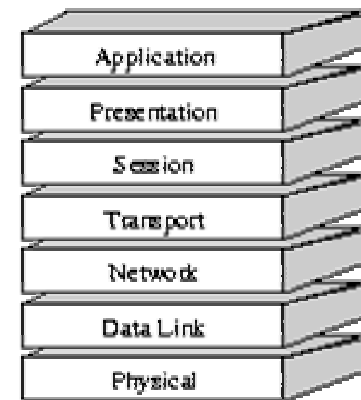
Concept 2: A 10-Layer Model of Interaction

- developed with Ben Bauer

- **OSI defined a 7-layer architecture model:**
- interaction broken down into a hierarchical set of **layers**
- each layer performs a **subset of the functions** required
- each layer **relies on the next lower layer** to perform more primitive functions and to conceal the details of those functions
- each layer **provides services** to the next higher layer
- **changes** in one layer do not require changes in the other layers
- **very useful for partitioning problems and reducing complexity**



OSI Model



Extension to HCI

A 10-Layer Model of Human-Technology Interaction



	Layer	Label	Description
HCI Layers	10	Human Needs	Provides description of the needs, desires, goals of the user during the interaction independent of any method or technology. Also addresses business issues: will it sell, to whom, where, when.
	9	Human Performance	Provides description of the social, perceptual, cognitive, motor etc. aspects of the communications.
	8	Input/Output	Provides description of the human input (keyboard, mouse, etc.) and output (display, sound) aspects of the interaction.
OSI Layers	7	Application	Provides services to the users of the OSI environment. It provides such services as FTP, transaction server, network management, etc.
	6	Presentation	Performs generally useful transformations on data to provide a standardized application interface and to provide common communications services. It provides services such as encryption, text compression and reformatting.
	5	Session	Provides the control structure for communication between applications. It establishes, manages and terminates
	4	Transport	Provides reliable, transparent transfer of data between end points. It provides end-to-end error recovery and flow control.
	3	Network	Provides upper layers with independence from the data transmission and switching technologies used to connect systems. It is responsible for establishing, maintaining and terminating connections.
	2	Data Link	Provides for the reliable transfer of data across the physical link. It sends blocks of data (frames) with the necessary synchronization, error control and flow control.
	1	Physical	Concerned with transmission of unstructured bit stream over the physical link. It invokes such parameters as signal voltage swing and bit duration. It deals with the mechanical, electrical, procedural characteristics to establish, maintain and deactivate

New HCI Layers

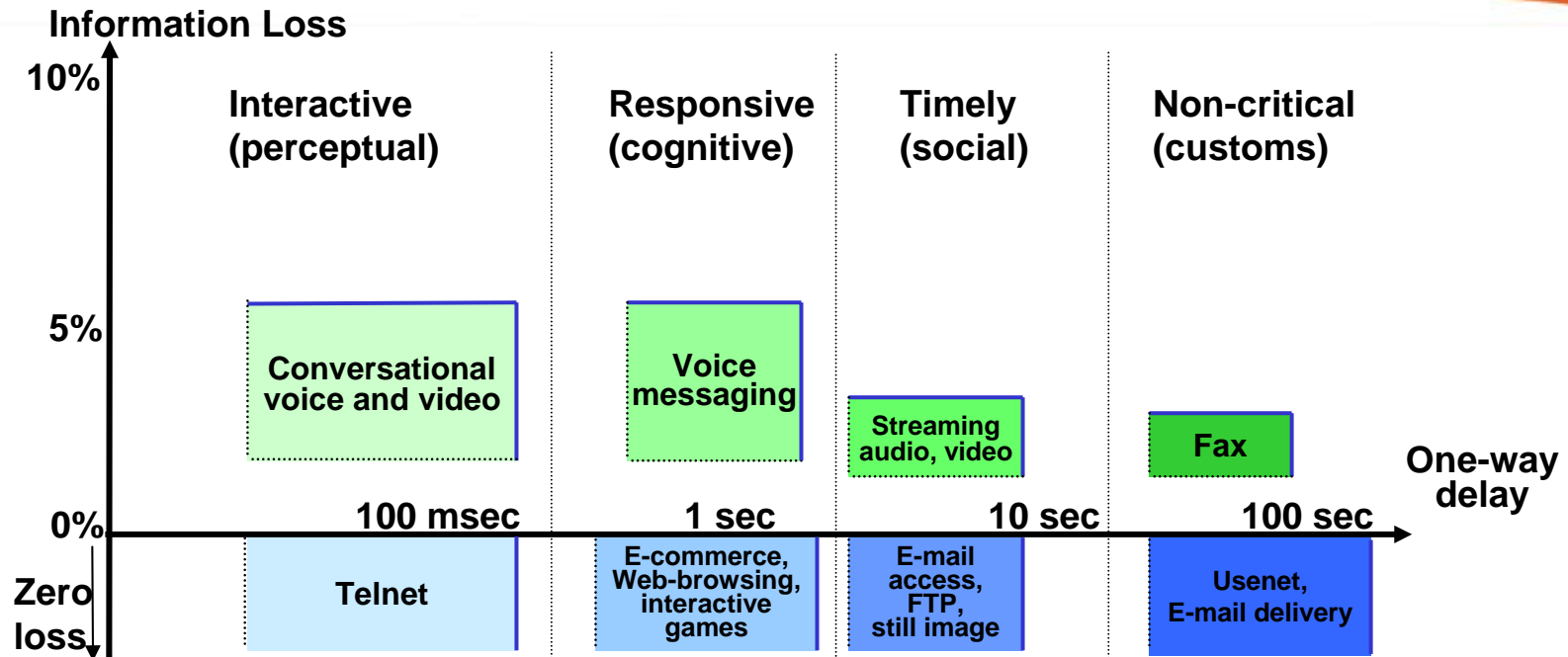
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Notes:

- layer 8 in HCI space is similar to OSI layers 1-2
- applies to IP services but also broadcast TV, VCRs, etc.
- illustrates difference between QoS (OSI) and QoE (HCI)

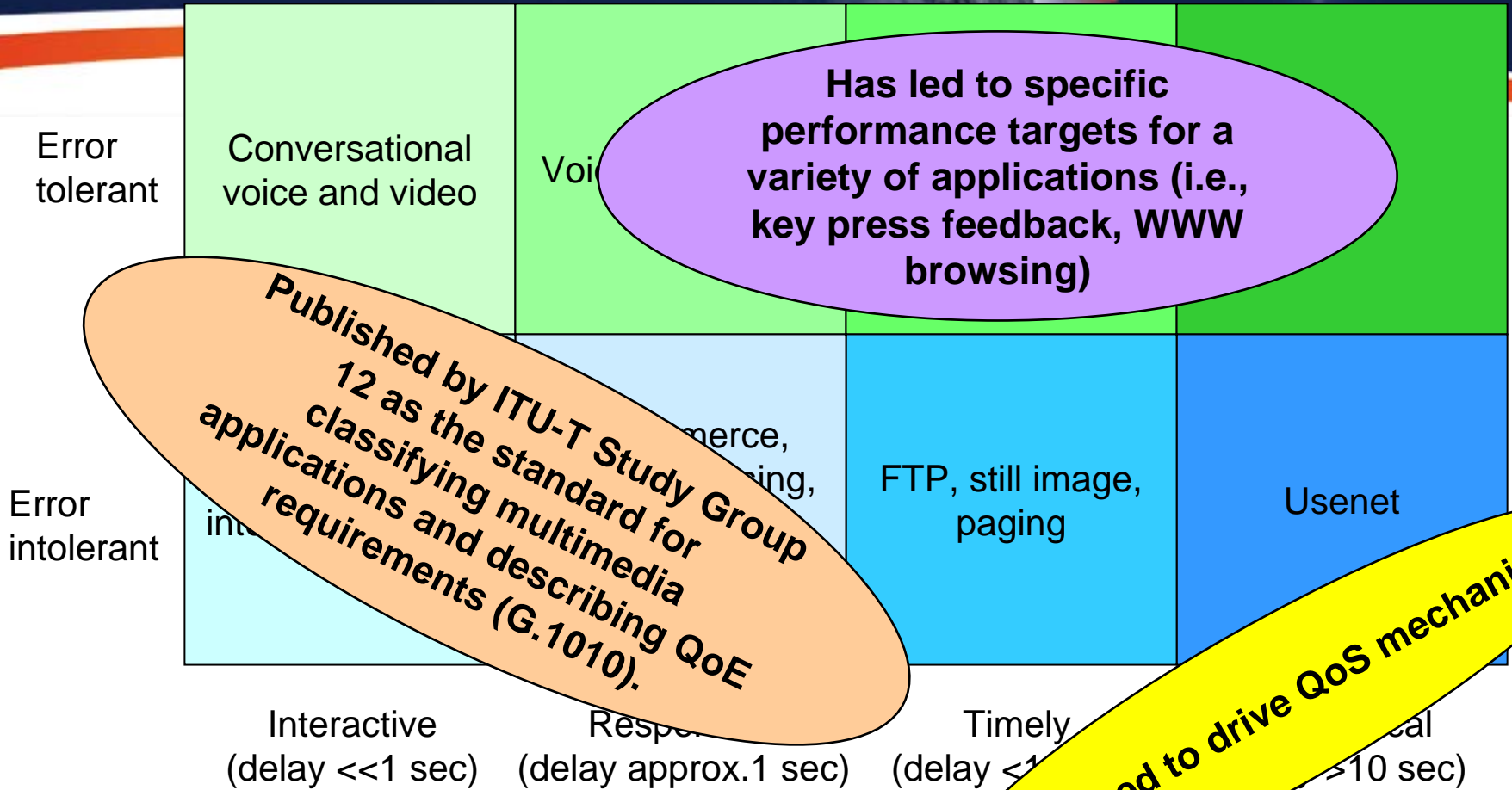
Concept 3: Application Categories Based on QoE Requirements

Developed with Paul Coverdale

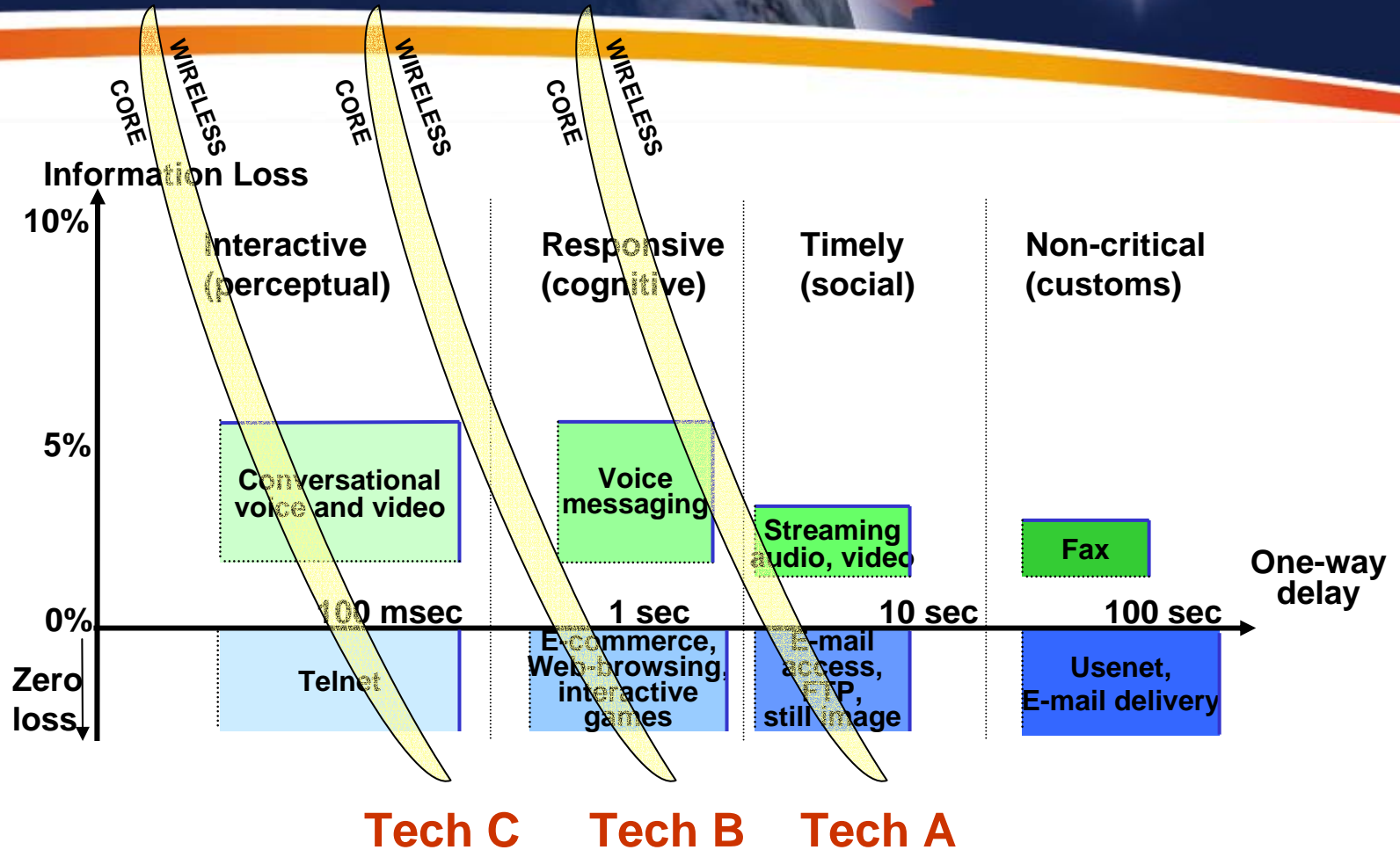


The edges of the boxes define the optimal engineering target zones for each service type.

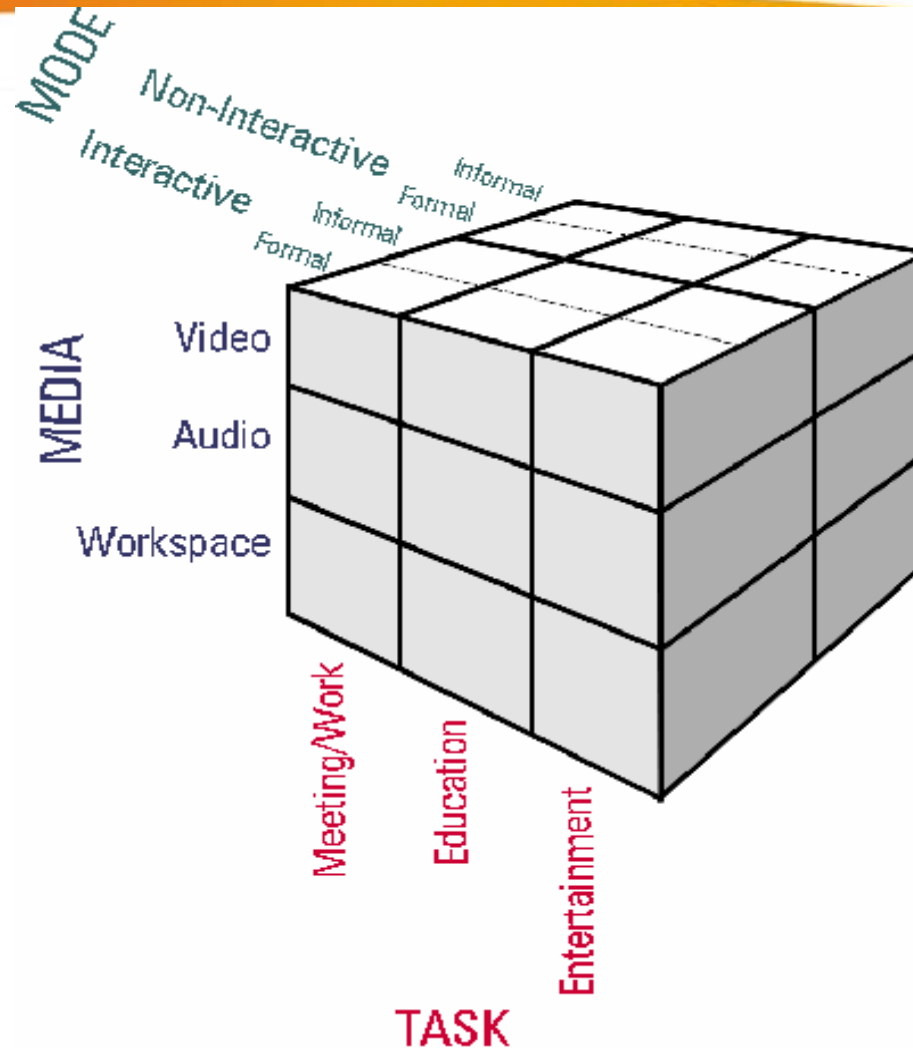
8 Application Categories



Technology Limits the Application Space

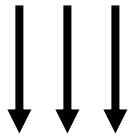


Concept 4: Dimensions of Experience

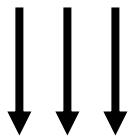


Layered Models

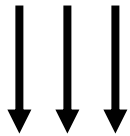
tasks



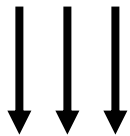
needs



requirements



services



technologies

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Task/Needs Matrix

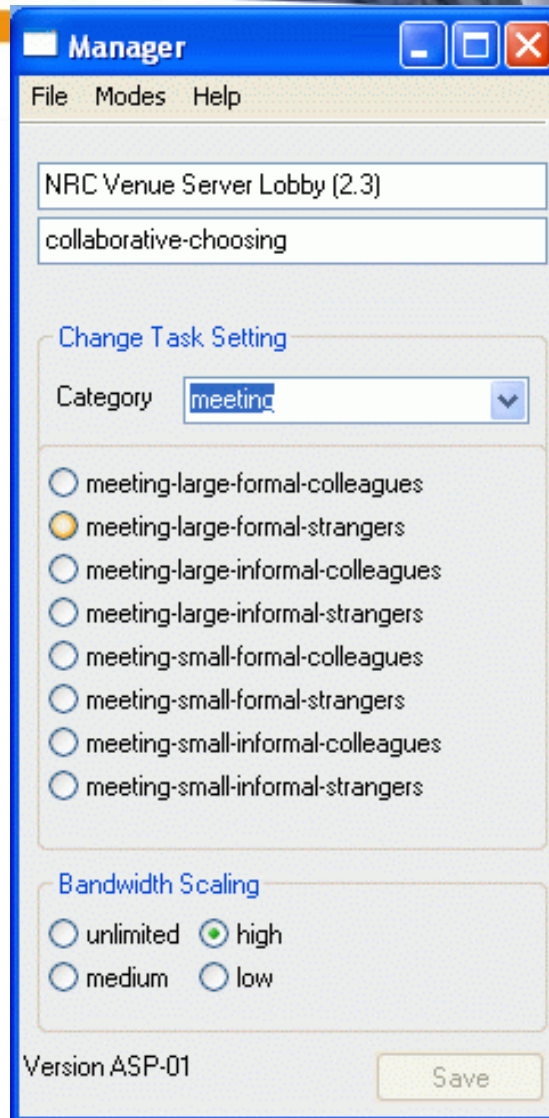
• The Task/Needs Matrix

- Task are rows, needs are columns
- Five major **task classes**
 - Meetings, collaborative work, education, presence, entertainment
 - Classes are subdivided as required
 - e.g., meetings subdivided on size, formality, familiarity
- Extensible set of **needs**
 - Auditory, visual, AV sync, workspace, presentation...
 - Each need has a set of **characteristics**
 - Audio: latency, fidelity, reliability
 - Workspace: textual, visual
 - Needs are **ranked in importance** for each task
 - Characteristics are given values that map to service quality

Task/Needs Matrix

Category	Task/Scenario	Requirements								
		auditory	visual	audio/video sync	shared workspace	presentation space	turn-taking	decision support	privacy controls	meta-comm
Meeting	meeting-large-formal-colleagues	10	9	6	5	7	8	7	4	6
	meeting-large-formal-strangers	10	9	6	5	7	8	7	6	6
	meeting-large-informal-colleagues	10	9	5	5	7	8	7	4	6
	meeting-large-informal-strangers	10	9	6	5	7	8	7	6	6
	meeting-small-formal-colleagues	10	8	8	9	4	4	3		
	meeting-small-formal-strangers	10	8	8	9	4	4	3		
	meeting-small-informal-colleagues	10	8	8	9	4	4	3		
	meeting-small-informal-strangers	10	8	8	9	4	4	3		
Collaborative Work	collab-generate ideas and plans	10	7	5	9	8	5			
	collab-choosing	10	8	8	7	7	5	9		
	collab-execute perform	10	8	8	9	5	4			
	collab-negotiate	10	8	8	7	6	6	8		
Education	edu-oneway-visual	9	10	5	7	9	8	8	2	7
	edu-oneway-verbal	9	10	3	8	7	8	8	2	7
	edu-interactive-visual	10	9	10	7	8	5	2	4	2
	edu-interactive-verbal	10	9	8	8	6	5	2	3	2
Presence	presence-general	9	10	1					8	7
	presence-remote monitoring	9	10	1					8	7
Entertainment	entertain-visual	9	10	7		4			7	8
	entertain-auditory	10	9	1		2			7	8

A QoE-Sensitive Interface to the Access Grid



Four Interrelated Concepts

- **Quality of Experience (QoE)**
- **HCI Extension to the OSI 7-layer model**
- **Classifying applications based on QoE requirements**
- **Dimensions of Experience**