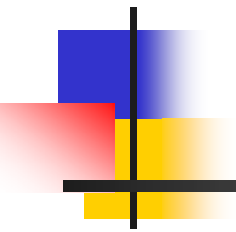
Future of PIM and Wireless Converged Services



James T Smith

Convergence or Confusion?

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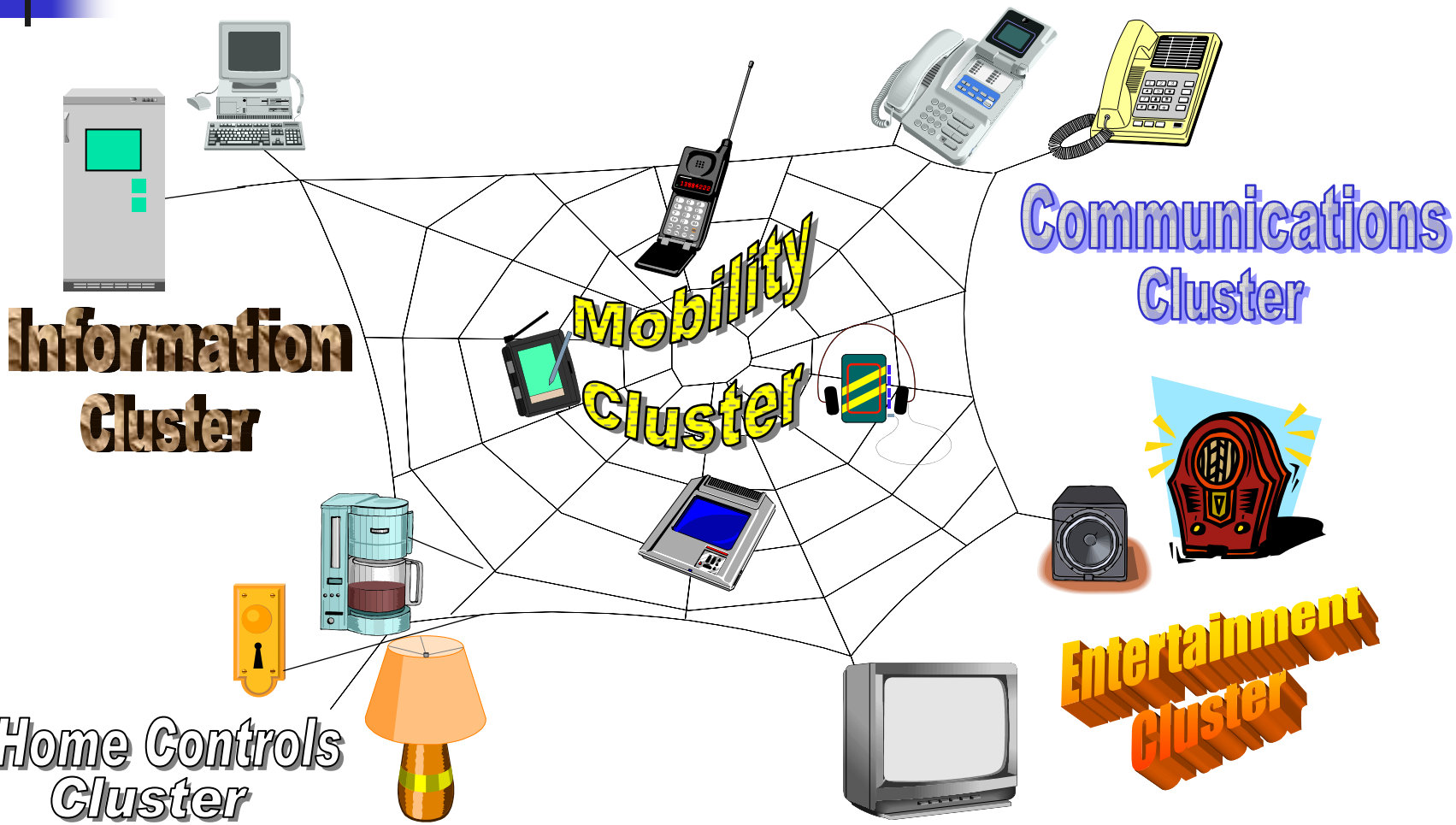


PIM Industry Perspective

- PIM and Wireless Converged Services
  - Convergence or Confusion?
  - Law of Disruption
  - Three Internet Waves
  - Expanding Our Vision
  - Achieving Convergence
  - Time for a Simple Example
  - Service Negotiation
  - Far-Reaching Consequences

Converged Services?

- Leverage Each Other
  - Whole is greater than the sum of its parts
    - That which is *legacy* is enhanced
  - Enabling *new capabilities* the component services could never deliver
    - As standalone services
    - As independent components of a package

Forces in Play Here?

- Moore's Law
- Metcalfe's Law
- Coase's Law
- Law of Disruption
- Law of Unintended Consequences

Law of Disruption

- ***Sustaining***
  - Incremental improvements
  - Faster, cheaper, quieter, etc.

- ***Disruptive***
  - Critical mass is attained
  - Social, political, and economic systems change

Sustaining Assumptions

- Telecom industry—carriers, vendors, etc.—accept as given
  - World's *data networks* converging toward common architecture—Internet-defined.
  - Migrating *telecom* to same architecture should provide opportunity for
    - Infrastructure *savings*
    - New *efficiencies* in network operations
    - *Consolidation* of services, etc

Sustaining Expectations

- Fundamental Assumptions Remain Valid
  - *Existing* products and services
    - To operate and to deliver value
    - Pretty much as they always have
  - *Existing* business models remain intact
  - *Existing* incumbent vendors, service providers, etc. are satisfied

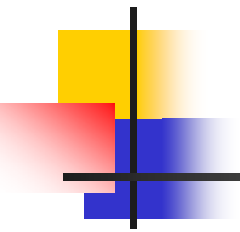
Disruptive Internet

- Internet's Propensity
  - *Supercede* incumbents best plans with fresh new approaches
  - Forcing the *reinvention* of what is, and
  - Forcing *creation* of what has not been previously considered.

Disruptive Consequences

- Traditional communications services
  - *Today*—Voice is voice, data is data, and never the twain shall meet!
  - But what about *tomorrow* ?
- Profoundly disruptive to incumbents
  - Who will develop the new services?
  - Who will offer them?
    - Through partnering, co-branding, etc.?
  - How will they be packaged?
    - Technically and business-wise?

Which One? VoIP or VoDSL?



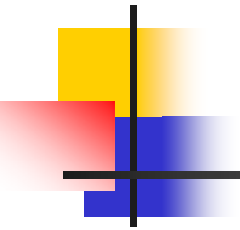
- With VoDSL?
  - Class 5 features are extended to the home, SOHO, via single pair
  - But its still just Class 5 stuff
- With VoIP?
  - What neat new services!
  - Leverage the Internet
  - But, who will offer them?

Another Disruptive Example

- Location-Based Services
  - Revenue models, enabling technologies, and the services themselves are much more complex than many believe.
  - Until standards emerge, they are subject to "**significant disruption**" from *still-emerging technologies*.
    - Rich Luhr, Director of Technology Strategy
    - **The Shosteck Group**

Converged Services?

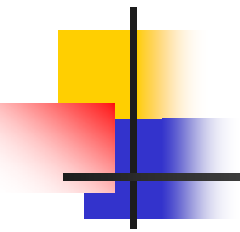
- Leverage Each Other
  - SUSTAINING:
  - Whole is greater than the sum of its parts
    - That which is *legacy* is enhanced
  - DISRUPTIVE:
  - Enabling *new capabilities* the component services could never deliver
    - As standalone services
    - As independent components of a package



Three Internet Waves

- Messaging
  - Data sharing
  - SMTP, MIME, FTP, PIM
- The Web
  - Application & resource sharing, packaging
  - HTTP, HTML
- Convergence
  - Collaboration—of data and applications
  - XML, SOAP, Java
  - SIP—Session Initiation Protocol

First Wave: Messaging

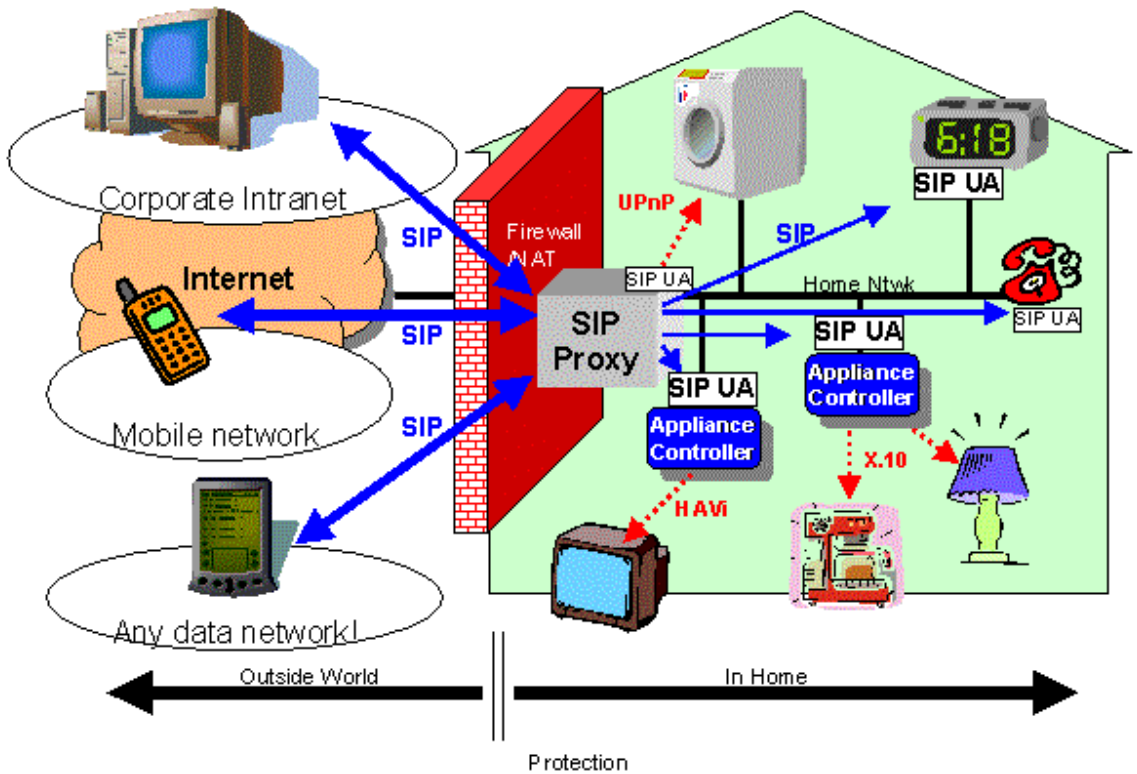


- Unified Messaging
  - Voice, fax, email, …
- Integrated Messaging
  - A new interface
- Unified Communications
  - IM-like profiles
- Adaptive Communications
  - Watch ‘n learn
- ActiveBuddy
  - IM to interact with
  - Intelligent agent

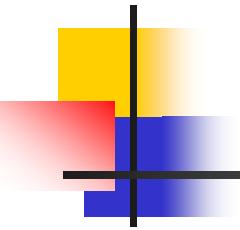
SIP & PIM—Not Just People

- Not restricted to person-to-person communications
- Communicator's Associate
  - Intelligent agent *in the network*
  - Rather than with another person
  - Equally plausible application of IM technology.
  - New services that leverage this modified model of IM already are emerging, e.g., ActiveBuddy
  - My *personalized* agent

SIP-PIM Enabled Home



http://www.argreenhouse.com/iapp/



Second Wave: The Web

- Packaging
  - Plethora of quasi-related protocols, tools, and services
  - Browser-based access to FTP sites, email servers, newsgroups, etc.
- Today's Mantra
  - If it can be done via the Web
  - Then it should be done via the Web!

Web-Enabled Services

- Combine more useful protocols, tools, and features of original plethora
  - Typified by multimedia-enabled webpage
  - Web-enabled *content*
    - *HTML-enabled email*—send and receive *personal webpages* via email transport
  - Web-enabled *applications*
    - *Browser-based access* to FTP sites, email servers, newsgroups, etc.

Web Meets Metcalfe's Law

- Web's Influence Not Limited to Web
  - *Local-to-the-machine* OS-centric functions have adopted Web paradigm.
  - Local file access and webpage access
    - Treated from a common metaphor
    - *URL's* in the file manager window
  - WebMin for admin & management
  - Web-enabled phones, IA's, IAD's, etc.
- Metcalfe's Law—Application Level

Third Wave: Convergence

- Three Levels, or Tiers
  - *Network*—shared *infrastructure*
  - *Application*—shared *resources*
  - *Service*—shared *results*
- *Converged Services*
  - Neither *pure voice*, nor *pure data*
  - But yet-to-be-determined *blends*

The Forest through the Trees

- Suddenly
  - The *converged whole*—the *forest*
  - Is of far greater value than that of the sum of the *individual parts*—the *trees*
- *Converged Services*
  - Neither *pure voice*, nor *pure data*
  - But yet-to-be-determined *blends*

Expanding Our Vision

- *Sustaining technology*
  - Broad enough to encompass — *Current*
    - Capabilities of individual services
    - VoIP, IM, UM, etc.
  - Will miss the next wave
    - AIN in the PSTN is an example of a *sustaining* vision
- *Disruptive technology*
  - Catches the incoming waves — *Future*
    - The Web is an example of a disruptive vision
  - Next killer-app
    - What customer quickly comes to view as *must-have*

Setting the Stage

- An Age of All-at-Onceness
  - Limitations due to time and space are being overcome
  - New models of *thinking*, of *organizing*, of *problem solving*
- We Are Borg'd (from StarTrek)
  - We are the Borg, We will assimilate you!

Time & Space Overcome

- Limitations due to time and space are overcome
  - Transcendence of *Time* — all the time
    - All news, all weather, all movies, ...
    - E-commerce, E-business, E-entertainment, ...
  - Transcendence of *Space* — *Wireless*!!
    - Total connectedness
    - Anywhere to anywhere
    - Ultimate realization of *Metcalfe's Law*

New Models

- *Thinking*, *Organizing*, *Problem Solving*
  - From linear cause-effective thinking processes
  - To discontinuous integral consciousness
    - Real-time interaction with what currently is happening
  - *"The medium is the message"*
  - They are inseparable — *Convergence*

—*Marshall McLuhan, Understanding Media: The Extensions of Man*

From Reception to Interaction

- From: *reception of information* model
- To: *interaction with* model
  - In contrast to broadcast, mass production model of the industrialized world
  - Internet *surfers* exercise *complete control* over the *relationship*
- Examples
  - ITERU will enable I-TV viewers to chat with other viewers of the same program
  - **Fatbubble** Instant Kibitzing

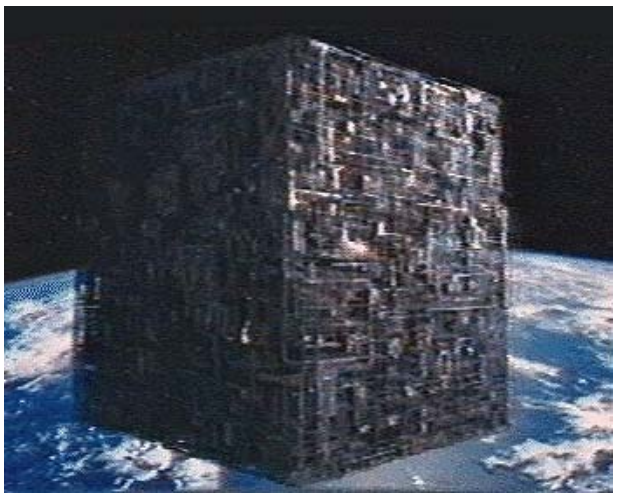
Your Presence & Your TV

- **I-TV Meets the Cell Phone**
  - **OpenTV** working with **ITERU**
  - I-TV platform includes unified messaging
  - Enable users to send and receive messages
    - Between their televisions and other TVs
    - With a variety of other devices including Wireless Application Protocol (WAP)-enabled phones
    - Messages as e-mail or instant messaging
  - Chat with other viewers of the same program
    - http://devices.internet.com/wired/news/2001/05/18/firms_to.html

Instant Kibitzing, Anyone?

- **Fatbubble** says about IM
  - *"something is missing"*
  - Make social the solitary activity of Web surfing
- Friends can
  - Monitor buddies while they surf the Web
  - See where their friends are browsing
  - Discuss or ridicule sites their peers are visiting
  - Share Web URL's
- Ready to "join the collective" ?

Ready to Be Borg'd?



- Ready to Be Borg'd?
  - *"We are the Borg, We will assimilate you!"*
- We believe we are about to offer
  - *"the greatest thing since sliced bread"*
- Customers may have mixed feelings

The Act of Communicating

- Part of a Larger *Context*
  - Customer would be better served
  - Synergism derived would greatly enhance such communications
  - Customer has demonstrated appreciation of, and need for contextual support

Achieving Convergence

- To achieve *converged services*
  - Where the whole is decidedly of more value than the parts
  - The force holding the parts together must be determined and addressed
- That *binding force* is *context*
  - Which the parts already share, in reality
  - Ought to share at the *service* level

Context Integration Required

- Next-gen communications apps—be they vertical or horizontal in nature—require "*context integration*" before they can deliver return on investment.
  - John Jainschigg, Editor of *Computer Telephony*, soon to be *Communications Convergence*

Context Integration—How?

- And *context integration*
  - Adapting infrastructure and applications to drive process and express strategy
  - Is a complicated business
  - Requiring great technical facility

Context Integration Involves

- Coupled with new forms of business savvy
  - Involves knowing how complex communications systems, workers, partners, and markets interact
  - In the *horizontal context* of general productivity
  - In the relevant *vertical domain*

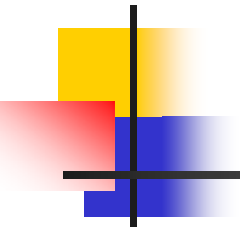
Customer Context Profile

- Related Papers of James Smith
  - *"AIN System Development—A Customer-Centered Approach,"* Integrating Telecommunications and Distributed Computing—from Concept to Reality (TINA-95), Feb. '95
  - *"AIN System Development: The Customer Centered Service Context Profile,"* International Communications Conference (ICC-95), Jun. '95

    http://ieeexplore.ieee.org/iel3/3942/11415/00525149.pdf

Far-Reaching Consequences

- Customer-Centered Service Management
- User Interface Synergism
- User Information Synergism
- Normalized Information & Processing
- Symbolic Declarative Information
- Flexible Intelligent Processing Strategy
- Information Abstraction & Late-Binding
- Feature Interaction & Negotiation Management



The Past: Circuit Switched

- Communications
  - Nice and neat standalone processes
- Minimal Contextual information
  - E911
  - Caller ID, & Calling Name Delivery
- Customer Must Compensate

Today: Telephony Services

- Still *Context Free*
  - No realtime context regarding *purpose* or *circumstance* of received phone call
  - The client-based answering machine's greatest use—a *context filter*!
    - One can determine *WHO* is calling
    - And just as importantly, *WHY* are they calling?
    - No other way to do this task, today!
- Customer Still Is Compensating
  - The latest Unified Messaging still cannot deliver

Tomorrow: Context Matters

- Context
  - *Cause-effect*—influences and events that caused particular event or situation
  - *Explanatory*—immediately before and after, and helps to explain
- Setting
  - Timing, locations, parties involved, etc.
- Presence
  - A person's *personal context*

Presence: A Definition

- ***Presence*** is the dynamically changing
  - Means
  - Willingness
  - Capabilities
  - Characteristics
  - Ability
- for users to communicate and interact with each other

Presence—in Perspective

- *Presence*
  - An appropriate *moniker* for that body of information that characterizes a *person*
- A person's *personal context*
  - Critical first step in the quest
  - For an ultimate comprehensive treatment of context

Personality : A Definition

- **per·son·al·i·ty** (pûr s -n l -t)
  - *Totality* of qualities and traits, as of character or behavior, that are peculiar to a specific person
  - *Pattern* of collective character, behavioral, temperamental, emotional, and mental traits of a person
  - *Distinctive* qualities of a person, especially those distinguishing personal characteristics that make one socially appealing

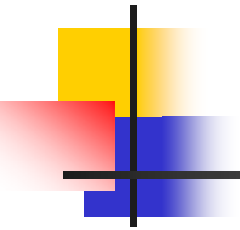
Myers-Briggs Assessment

- Can we do even better?
  - If *explicit* presence is lacking
  - Can enough be *inferred* to compensate?
  - Please give me a ‘hint’?
  - Your Myers-Briggs Type?
  - Then I will adapt to you!

Myers-Briggs Types

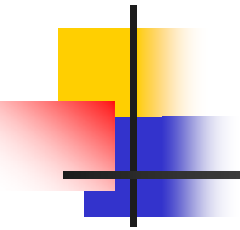
- **ENFJ** - Pedagogue
- **ENFP** - Journalist
- **ENTU** - Field Marshall
- **ENTP** - Inventor
- **ESFJ** - Seller
- **ESFP** - Entertainer
- **ESTU** - Administrator
- **ESTP** - Promotor
- **INFJ** - Author
- **INFP** - Questor
- **INTU** - Scientist
- **INTP** - Architect
- **ISFJ** - Conservator
- **ISFP** - Artist
- **ISTJ** - Trustee
- **ISTP** - Artisan

http://www.pendulum.org/misc/mb.htm



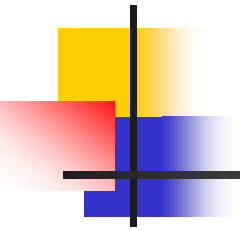
Time for a Simple Example

- The Use-Case
  - Setting: at home, say in the gameroom
  - Activity: on-line, shopping via the Web
  - Purpose: need to replace an appliance
  - Action: invokes PC-call via embedded icon
  - Needs: to bring wife into the discussion



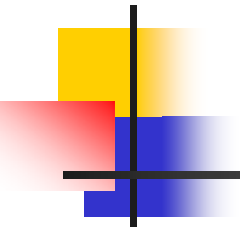
Simple Questions

- Questions
  - Where is she? How is she contacted?
  - How is the context conveyed to her?
  - How do we all conference together?
  - How is the context managed?
  - When I arrive to examine the product?



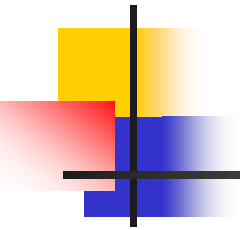
How to Contact?

- Where is she? How is she contacted?
  - In the kitchen, use her webpad?
  - At the kids' school, use her cell phone?
  - In her automobile, use hands-free setup?
- What networks are involved?
  - WAN? Cable, DSL, dial-up ?
  - LAN? cat-5, phone, coax, wireless
  - Cellular?



How to Convey Context?

- How is the context shared with her?
  - Share the same web image?
  - Tailor to her user device?
  - Scope to her need-to-know?
  - Can I park the context to pick it up later?

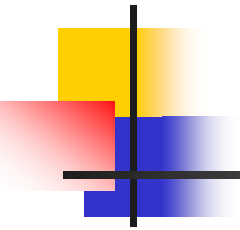


Collaboration?

- How do we all *conference* together?
  - Call back on a conference bridge?
  - Are ‘asides’ supported?
  - Can a snapshot (voice, text, etc.) summary be archived for later use?
- How do I retrieve the *parked context*?
  - While in my car? For driving directions?
  - At the store? *Informed* serviceman?

Do's and Don'ts

- DO desire *context* of the conversation
  - To be provided to all involved parties
  - To myself, to my wife, and to the customer representative
- Do NOT wish to be burdened with
  - Thinking about *where*
    - Which networks should be used
    - Home/local, wireline, wireless?
  - Thinking about *how*
    - Right sequence of menu clicks, keypad strokes, etc.



Where Is the Context?

- Time for a Transition
  - We understand how to *park a call*
  - So, how should we *park a context*?
- Today
  - Ancillary contextual information
  - Captured separately from the call processing
- Tomorrow
  - Convergence of communications with the context it supports

But We've Tried, Already

- **AIN**—*Advanced Intelligent Network*
  - User's management interface
  - Service's *disconnectedness* from other context management tools and services
  - Inability to integrate the wishes of *all parties*—both the *caller* and the *called*.
- More Fundamental Problem
  - No context sharing by ALL parties
  - No means to *negotiate* or to *compromise*

AIN—Strategic Mistake

- AIN—Conceived as *Sustaining*
  - To be cheaper, faster (to market), etc.
  - With pretty much the “same old stuff”!
  - Dare switch vendors & carriers do more?
- I tried to warn! (in 1995)
  - *“AIN System Development—A Customer-Centered Approach”*
  - *“AIN System Development: The Customer Centered Service Context Profile”*

Remember Law of Disruption

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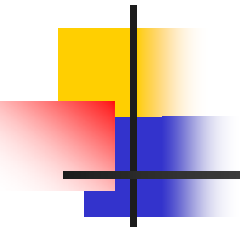


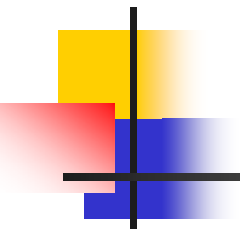
Solution: Service Negotiation

- Negotiation
  - Strategically important value of *context*
  - Key to sophisticated *feature interactions*
- Historically
  - Limited state of affairs
    - All but simplest feature interaction problems intractable
  - No mechanisms for parties to *negotiate*
    - No protocols, no infrastructure, …
    - From ambiguous or equally plausible alternatives

Customer Innovates Again

- The Customer Shows Us the Way!
  - PAST: context-enabled call *filtering*
    - *One-way flow*
    - Adapted Caller-ID and answer machine
    - Implement his own version of context-enabled call filtering
  - NOW: basic service *negotiation*
    - *Two-way interchange*
    - Applied IM—textual and voice
    - Negotiation of voice services, and more

So, How Do They Do It?



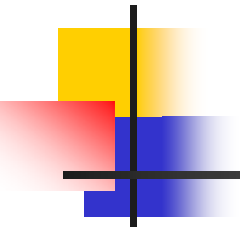
- IM—ad hoc negotiation mechanism
  - Negotiate the *setting*
    - People involved, meeting times, places, etc.
  - Negotiate the *context*
    - What to bring, or to have ready, etc.
- Not just for calls & meetings
  - Negotiation is a core *behavior* of humans
  - *Intelligent* services must support it!

Paradigm Shift

- PCS service package—1st minute free
  - The cell phone is left *"On"* to receive
  - Two calls for one conversation
    - 1st minute to *negotiate* the latter call
    - Latter call via same or different handset
- What do we have? Voice-Enabled IM
- One more time:
  - The cell phone is left *"On"* to receive

Voice-Enabled IM?

- **One Voice Technologies Inc.**
  - Enables users of any type of phone
  - To create, send and respond to e-mail, text, and paging messages
  - Users perform messaging tasks with their voices
  - Easier than limited capabilities of most mobile devices
  - In-car usage is now safer



Voice Chat & The Masses

- The goal of voice integration
  - Not to replace text chat
  - But to complement it
- Ten percent of IM conversations result in a telephone call
  - Survey by Edge Research, July 2000
    - http://www.edgeresearch.com/

Mobile IM Another Way?

Figure 1

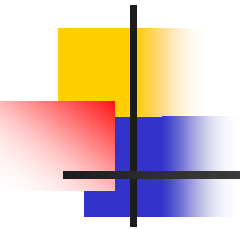
- **K Laboratory** Mobile IM
  - New IM for mobile phones
  - Compatible with Yahoo IM
  - Users can adjust IM settings in real-time
  - Showing status such as on- or off-line, "Busy", or "Away"
- Simple Negotiation Enabled

Time to Try Again

- Service Negotiation Enablers
  - Context Management
    - Personal context—PIM, etc.
    - Situational context—opportunity to define
  - Negotiation Protocols & Framework
    - SIP—a first approximation
    - CNP—Contract Net Protocol
    - KQML—Knowledge Query Manipulation Language http://www.cs.umbc.edu/kqml/
    - DAML—DARPA Agent Markup Language http://www.daml.org/index.html

The Semantic Web

- Essential Property—Its *Universality*
  - The power of a hypertext link
  - *"… anything can link to anything."*
- Semantic Web—*Decentralized*
  - ..Unanswerable questions are a price that must be paid to achieve versatility
  - *"We make the language for the rules as expressive as needed to allow the Web to reason as widely as desired."*



Semantic Web's Challenge

- Providing a language that
  - Expresses both data and rules for reasoning about data
  - Allows rules from existing knowledge-representation systems to be exported onto the Web
- Adding logic to the Web—the Means
  - To make inferences
  - To choose courses of action
  - To answer questions

A Negotiation Protocol

- **Contract Net Protocol (CNP)**
  - A distributed interaction protocol for cooperative problem solving among agents
  - Born in distributed AI community, early 1980s
  - The distributed agent nature of mobile IP lends itself naturally to the application of CNP
  - Can be applied to mobile IP and/or other micro-mobility proposals to provide distributed handover negotiation mechanism
  - Provides solution to connection problem: i.e. finding appropriate agent to work a given task

Negotiation Classics

- **Contract Net Protocol**
  - Smith, R.. *"The contract net protocol: High-level communication and control in a distributed problem solver,"* IEEE Transactions on Computers, C-29(12):1104-1113, 1980.
  - Davis R; Smith R G. *"Negotiation as a metaphor for distributed problem solving,"* Artificial Intelligence, 20,1,63-109, 1983.
  - Smith R.G., Davis R., *"Frameworks for Cooperation in Distributed Problem Solving,"* IEEE Transactions on Systems, Man, and Cybernetics, Vol. SMC-11, No 1, January 1981.

Calling All Agents

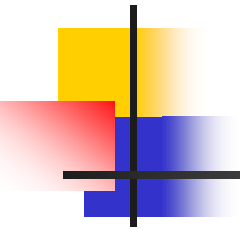
- **Person-to-Agent** — *"Make it so!"* (Picard)
  - **ActiveBuddy**
  - **Communicator's Associate**
  - "… it effectively becomes my ***administrative assistant***—able to effectively direct me in the most promising directions, and to assist me along the way!"
- **Agent-to-Agent**
  - "Both agents know the complete task-sets of both users. At the end, each agent proposes a deal that is optimal."
  - Working behind the scenes in our behalf

Agent References

- **More References**
  - *"My Agent Will Call Your Agent"* Chris Oakes, Wired, October 20, 2000
  - *"The Role Directories Will Play in the Coming Digital Economy,"* GTE Electronic Commerce Technology Conference, October 7, 1998
  - Second International Workshop on Mobile Agents for Telecommunication Applications, September 18-20, 2000
    - http://netconf.lip6.fr/mata00/
  - *"Applying Contract net Protocol to Mobile Handover State Transfer",* Phillip Neumiller, IETF Draft, Nov. 27, 2000
    - http://www.ietf.org/internet-drafts/draft-neumiller-seamoby-cnpmobility-00.txt
  - The Semantic Web
    - http://www.sciam.com/2001/0501issue/0501berners-lee.html

Services to Do—Now !

- Well-Connected Home (or, Auto, __)
  - Scenario
  - Each family member has own cell phone
  - Plus, a **virtual home number**
    - No physical device with this ID
    - Can be *picked-up* by any of the family
    - House-icon, distinct ring indicate house call
  - PIM-supported to know when at home
  - Features of TeleGO, without limitations



Far-Reaching Consequences

- Customer-Centered Service Management
- User Interface Synergism
- User Information Synergism
- Normalized Information & Processing
- Symbolic Declarative Information
- Flexible Intelligent Processing Strategy
- Information Abstraction & Late-Binding
- Feature Interaction & Negotiation Management

Customer-Centered Services

- The Customer Uses Terms that Are Meaningful to Him
  - To Interact with Service Management
  - To Organize and Manage Information
  - At a Declarative Problem-Statement Level
  - Independent of the Procedural Implementations of those Services
- Consider
  - If only have solutions, then what is the problem?
  - A given problem may have many solutions!

User Interface Synergism

- Consistent 'Look-n-Feel' Across All User Interfaces & Paradigms
  - Symbolic Label—Multiple Interface Representations
    - Textual *Family*, Verbal *Family*, & Icon *Family*
  - Traditional DTMF, PC, GUI Interfaces
  - Multi-Lingual Natural Language Interfaces

User Information Synergism

- Customer-Provided Information Should Be
  - Entered & Managed
    - In Customer-Centered Terms
    - In a Consistent Manner Independent of UI
    - Once (per Item Update)
  - Independent of
    - Which, How Many, or What Types of Services Are Subscribed
    - Which Do or Could Depend Upon that Information

Normalization

- Vertically Normalize Management of Each Synergized Information Type
  - Encapsulate the Representation & Processing of Each Information Type
  - Plug-n-Play Model of Information Management and Usage
  - The Management & Use of Each Type of Plug-n-Play Information Is a Distinct Subscribable Capability

Symbolic Declarative

- Symbolic Entities & Statements
  - Independent of Their Underlying Representations and Implementations
  - Express What Service Behavior or Activity Is Desired by the Customer
  - Problem-Centered Rather than Solution-Centered

Customer Service Profile

Time	From	Customer	System	Feature	Option	Value
*	Wife	*	TimeOut	TeleMail	MailBox	Msg-Wife
Office	Boss	Involved	Busy	FlexFwd	Alert	Boss
Office	Sect.	Quiet	Busy	FlexFwd	Alert	Sect.
*	Family	*	TimeOut	TeleMail	MailBox	Msg-Family
Office	*	*	Busy	TeleMail	MailBox	Msg-Std
Office	*	Lunch	TimeOut	TeleMail	MailBox	Msg-Std
*	*	Mobile	*	FlexFwd	Fwd2	Pager
*	Special	Mobile	*	FlexFwd	Fwd2	UptNum
Office	*	Lunch	*	TeleMail	MailBox	Msg-Std
*	*	Meeting	*	FlexFwd	Alert	Quiet
*	Sect.	Meeting	*	TeleMail	Alert	Loud
Late	Wife	*	TimeOut	FlexFwd	Ask	PageMe
*	*	*	*	CND	Alert	*
*	?	*	*	FlexFwd	Request	ID-Msg

Intelligent Processing

- Symbolic Declarative Representation
  - Neutral to Specific Service Features
  - Provides Basis for Unlimited Flexibility
    - Applied to Many Different Applications
    - Utilized in Different Ways (Purposes) under Different Circumstances
  - Only the Customer's 'What' Is Specified
    - *'When'* & *'How'* Resolution Are Left to the Network

Abstraction & Late Binding

- Applicable to ALL Network Elements
  - Horizontal Layers of Abstraction
    - Symbolic Information at Each Layer
    - Declarative Abstraction (Model) of Processing (Procedures) of Lower Layers
  - Different Real-Time Circumstances
    - Applicable to Different Requirements
    - Mapped to Different Procedural Realizations
  - Information Abstraction => Service Capability Reuse

Interaction & Negotiation

- General Service Execution
  - Customer Contexts = Preferences
  - Heuristically Select Service Context
    - Better Matches Customer Preferences
    - Is Compatible with System States and Capabilities
  - Utilize Customers' & Systems' Preferences
    - Negotiate Behavior to Be Delivered
    - Provide Acceptable Behavior to Involved Parties
    - Meaningful Degradation of Services

Feature Interactions

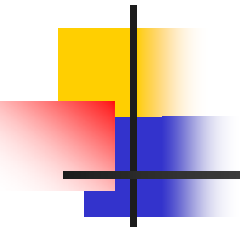
- Undesirable Feature Interactions
  - Single-Customer Interactions
    - Example: Call-Forwarding v. Call-Waiting
    - Solution: Provide Capability to Identify Preferences for Different Contexts
    - Result: Interaction => Coordination
  - Multi-Customer Interactions
    - Example: Caller-ID v. Call-Blocking
    - Solution: Provide Capability to Negotiate Acceptable Compromises
    - Result: Impasse => Negotiation

Negotiation—Defined

- Negotiation -- Iterative Process
  - Announcement — Pose Need to Other Entities
  - Bid — Receive Offers from Responders
  - Award — Accept Best Offer of Assistance
- Variations in the Process
  - Counter-Offers
  - Teaming & Coordination
  - Subcontracting - Secondary Negotiations

Negotiation Characteristics

- Fundamental Components
  - Exchange of Information
  - Evaluation of Exchanged Information
  - Final Agreement
- Preparation for Negotiation
  - Absolute Bounds
  - Compromise Fall-Back Positions
  - Evaluation Criteria



Negotiation Examples

- Types of Simple Negotiation
  - Credit-Card Calling — Trust Me !
  - Collect Calling — Will You Accept ?
  - Person-to-Person — No One But You !
  - Cellular Roaming Plans
- Parties Involved in Negotiation
  - Between Calling Parties
  - Between Calling Party & the Network
  - Between Networks

Feature Negotiation Goals

- Secure Acceptable Service Behavior
  - As Satisfactory As Possible
  - Avoid Behaviors Unsatisfactory in Context
  - Criteria: Behavior, Quality, Cost, etc.
- Leverage Concepts Previously Discussed
  - Symbolic Declarative Constructs of Customer's Service Administration
  - Self-Knowledge Incorporated within AIN Features & Capabilities
  - Feature Manager => Negotiation Agent

Negotiation Infrastructure

- Symbolic Declarative Taxonomies
  - Customer Requirements
    - Privacy, Alerting, Security
  - AIN Feature & Capabilities
    - Call-Blocking, Caller-ID, PIN-Screening
  - Associate Requirements & Capabilities
    - Privacy => Call-Blocking
    - Alerting => Caller-ID
    - Security => PIN-Screening

Negotiation Infrastructure

- Taxonomies & Cross-Reference Req's
  - Should Reflect Logical Patterns
    - From Abstract Generic to Concrete Specific
      - Alert, Alert Quietly, Alert Quietly w/ Pager LCD, ...
      - Acquaintances, Friends, Close Friends, Johnny
    - Directly Related v. Analogously (Heuristically) Related
      - Messaging (Email) Is a Form of Passive Alerting

Negotiation Heuristics

- Satisfy the Request
  - At a Level of Specificity >= the Request
  - At a Level of Specificity < the Request
  - Based on a Subset of the Request
  - Based on Economical (Cost, Resource, etc.) Generalization of Solution
  - Based on Any Generalization of Solution
  - Based on Any Generalization of Request
  - ...

So, Where Are We?