People and Policies
*Transforming the Human-Computer Partnership*

Rob Barrett
IBM Almaden Research Center

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Context: Autonomic Computing

- IBM’s Autonomic Computing Initiative
  - Radical transformation of systems management
  - Increase system capabilities through automation
  - *Transform system administration into supervisory control*
    - From low-level configuration to high-level policies
    - Self-{Configuring, Healing, Optimizing, Protecting}

- Role of Policies
  - Language for controlling autonomic systems
  - Guidance for decision-making
Outline

- Distinctive Features of the Policy Model
  What should the user of a good policy-based system experience?
  What opportunities do policies offer for more usable systems?

- Implications for Policy-Based Systems Management
What are Policies? What is a Policy-Based System?

- Difficult to decide if something is a policy or not
  - HTTP server to listen on port 80
  - Run backup every Sunday at 2am
  - Backup weekly with minimal impact on operations

  “Policies provide guidance for decision making by providing goals, plans and methods”

- Proposal: define as continuum in terms of interaction with people
1/6 – Vocabulary

- Shift toward human-centric terminology

<table>
<thead>
<tr>
<th>Computer-Centric</th>
<th>Human-Centric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Port 80</td>
<td>Well-known web server port</td>
</tr>
<tr>
<td>(.(mp3</td>
<td>wav)</td>
</tr>
<tr>
<td>Data_rate &gt; 1 Mbps &amp; access_time &lt; 5 seconds</td>
<td>Streaming music with Bronze service</td>
</tr>
</tbody>
</table>
2/6 – Embodied Expertise

- Westerinen: policy “enables reuse and duplication of an expert’s knowledge and processes”

Comply with Security Directive XYZ

Detailed Policies

Applications
Database
Application Server
Servers
Storage devices
Networks

3/6 – Span of Control

- Moves from components to systems and business processes
4/6 – Generality and Specificity

- “Constitution and Law” paradigm
  - Overarching principles that change slowly and require authority to overrule

- Example: data retention
  - General: “Unused data is retained for at least one year”
  - Specific: Email_retention = 3 years; News_retention = 1 year
  - Advantage: Provides useful bound for clients

- Example: commerce discounts
  - General: “Customer discounts must be no more than 15%”
  - Specific: Bronze_disc = 5%; Silver_disc = 10%; Gold_disc = 15%
  - Advantage: Allows confident delegation of control to possibly unreliable people/systems
5/6 – Separate Goals and Methods

- Dijker: when writing human-readable policy documents, should refer to external documents for processes that implement policies.

- Policies expressed as implementation are:
  - Inscrutable
  - Inflexible
  - Brittle

- Method: Cron script
  - Bad Goal: Launch backup every Sun at 2am
  - Goal: Backup every week
  - Better Goal: Ensure backups are never more than a week old

- Hint: procedures often imply undocumented policies (bad)

6/6 – Progressive Grounding

- Higher-level communication implies progressive development of common understanding
  - Increased possibilities of miscommunication with underspecified desires
  - Conflicts must be resolved based on complex knowledge

- Example: Executive & Secretary
  “Schedule flight to NY on Wed, non-stop, departing between noon and 2pm”
  “A non-stop will be very expensive on such short notice”
  “If I reschedule your 10am meeting for the previous day…”

- Example: Scheduling mainframe OS upgrade
  “Upgrades permitted during Sun maintenance window”
  “Argh! Don’t do risky upgrades over a holiday weekend!”
  “Security vulnerabilities must be fixed within one day”
Outline

✓ Distinctive Features of the Policy Model
  • Vocabulary
  • Embodied Expertise
  • Span of Control
  • Generality and Specificity
  • Separation of Goals and Methods
  • Progressive Grounding

⚠ Implications for Policy-Based Systems Management
  • Policy Development
  • Policy Operations
Implications: Policy Development

- **Kephart & Chess:**
  “The enormous leverage of autonomic systems will greatly reduce human errors, but it will also greatly magnify the consequences of any error humans do make in specifying policies.”

- **Dijker:**
  “There are too many potential consequences of establishing a policy to leave its development to a single individual.”

- **Development of policies is a complex social process**

  ![Diagram showing stakeholders in policy development: Responsible Agent, Stakeholder, Domain Expert, Writer, Policies]

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Policy Development Lifecycle

- Combines complexity of software development and operations

Requirements
  - Design
  - Coding
  - Testing
  - Packaging
  - Versioning

Software Development
  - Staging
  - Deployment
  - Monitoring
  - Problem Determination
  - Maintenance
  - Sunset

Policy Design

Policy Language

Policy Interaction

Policy Revision
Implications: Policy Operations

- Trust
  - Untrusted systems are left undeployed or subverted
  - Transparency, Bounded Behavior, Levels of Automation

- Situation Awareness and Expertise
  - History of Automation: too much demanded of humans at wrong times

- Unpredictable
  - Constraint-based engines find unexpected solutions
    *The Monkey’s Paw* (W. W. Jacobs)
  - Justify behavior, Disclose plans, Incremental interaction
Conclusions

- Important to understand implications of policy for human-computer partnership
- “Policy-ness” of system depends on human experience
- Shift of responsibility toward computer implies changes in Technology
  Organizations, Individual skills and roles
  Interfaces between Technology and People