LECTURE 3: ARCHITECTURES: SUPPLEMENTARY SLIDES ON PLAXTON ROUTING
Plaxton Routing

• Plaxton, Rajamaran and Richa: mechanism for efficient dissemination of objects in a network, published in 1997
  – Before P2P systems came about!

• Basic idea: prefix-oriented routing (assume fixed no. of nodes)
  – Store object ID=A at node with ID of longest common prefix with A
    • If many such nodes exist, choose node with longest common suffix
  – Goal: uniform data dissemination
  – Routing based on pointer list (object – node mapping) and neighbour list (primary + secondary neighbours)

• Basis for well-known DHTs Pastry, etc (and follow-up projects)
  – Method adapted to needs of P2P systems + simplified
Pastry: Topology

• **Identifier space:**
  – \(2^l\)-bit identifiers (typically: \(l = 128\)), wrap-around at \(2^l - 1 \leftrightarrow 0\)
  – Interpret identifiers to the base of \(2^b\) (typically: \(b = 4\), base 16)
  – Prefix-based tree topology
  – Leaves: *keys & node IDs*; (key, value) pairs under numerically closest node

![Diagram of Pastry topology]

\[l=6: \text{6-bit identifiers} \quad b=2: \text{base 4}\]
Pastry: Routing Basics

• **Example**
• Goal: find node responsible for $k$, e.g. 120
• Tree-based search for lookup($k$)
  – Traverse tree search structure top-down
• Prefix-based routing for lookup($k$)
  – Approximate tree search in distributed scenario
  – Forward query to known node with longest prefix matching $k$
Pastry: Routing Basics (/2)

• **Routing in Pastry:**
  
  – Each step, route towards “numerically” closest node
    
    • That is, query is routed to a node with a one character longer prefix (= \( b \) Bits)

\[ O(\log_{2b} N) \] routing steps

– If that is not possible:
  
  • Route towards node numerically closer to \( ID \)
Pastry: Routing Table

• **Routing table**
  – Long distance links to other prefix realms
  – \( l/b \) rows: one per prefix length
  – \( 2^b - 1 \) columns: 1 per digit different from local node ID
  – Routing table for node 120:

<table>
<thead>
<tr>
<th>?xx:</th>
<th>011</th>
<th>1</th>
<th>-</th>
<th>301</th>
</tr>
</thead>
<tbody>
<tr>
<td>1?x:</td>
<td>102</td>
<td>-</td>
<td>2</td>
<td>-</td>
</tr>
<tr>
<td>12?:</td>
<td>0</td>
<td>-</td>
<td>-</td>
<td>123</td>
</tr>
</tbody>
</table>