My Generation: Advances in Utility Network Visualization

Tony DiMarco
Business Consultant
Autodesk Global Services
We may make statements regarding planned or future development efforts for our existing or new products and services. These statements are not intended to be a promise or guarantee of future availability of products, services or features but merely reflect our current plans and based on factors currently known to us. These planned and future development efforts may change without notice. Purchasing decisions should not be made based upon reliance on these statements.

These statements are being made as of December 4, 2013 and we assume no obligation to update these forward-looking statements to reflect events that occur or circumstances that exist or change after the date on which they were made. If this presentation is reviewed after December 4, 2013, these statements may no longer contain current or accurate information.
Energy Utilities: An Industry in Transition

- Field personnel make up a large portion of the typical utility workforce
- Connection with field workers is vital
- Retiring workforce (55-60) and planning for replacement is top utility management concern
- Mobile worker and mobile technology now top-of-mind in utilities
- Technology for the Next Generation utility field worker
Utility Mobility Trends

IDC Energy Insights
- 40% of EMEA utilities expect to increase their workforce mobility over next 12-18 months
  - Embracing mobility to significantly enhance productivity
  - 26% already have mobility strategies in place

PA Consulting
- Being smart with the mobile utility
  - Reporting 23% increase in service-level agreement compliance
  - 10-20% improvement in field force productivity
  - By addressing efficiency, reliability, safety
Business Value Benefits – Mobility

- Both quantitative and qualitative benefits can be realized through the implementation of mobile technologies

Potential Quantitative Benefits
- Labor productivity / knowledge transfer
- Reduction in number of field visits
- Reduction in redesign and rework
- Business process improvement / standardization

Potential Qualitative Benefits
- Transform service delivery
- Quality
- Safety
Major Electric and Gas Utility in North America

Recently implemented field applications using Android devices for “Gas Leak Survey” and “Call before you Dig” applications

Facing numerous technological obsolescence and planning issues for next generation of field mobile applications

Curious about Google Glass and how that might fit into mobile strategy

Initiated an Advanced Technology Assessment with Autodesk Consulting to assist in developing immediate and long term planning perspectives and “replacement insights”.

© 2013 Autodesk
Autodesk Company Confidential
Two Field Activities Studied

811 Locate and Mark

Gas Leak Survey
Advanced Technology Assessment Study
Locate and Mark | Findings

- Scheduling inefficiencies and artificial geographic constraints on resource re-scheduling
- Contractor frustrations leading to “dig ins”
- Table screen legibility and map fidelity issues
- Equipment in truck (tablet, laptop, cell phone, GPS, wireless, locate equipment)
- Open ended process often missing feedback on true located facilities and map corrections
- Limited supervisor visibility of resources in field
Gas Leak Survey | Findings

- Table screen legibility and map fidelity issues
- Equipment in truck (tablet, laptop, cell phone, GPS, wireless, locate equipment)
- Open ended process often missing feedback on true located facilities and map corrections
- Meter bar coding information not utilized
- Limited supervisor visibility of resources in field
Opportunities

- **Dynamic scheduling** to improve productivity, customer experience, fuel costs
- **Collaboration**: introduce scheduling options to customer earlier in process
- Improve *asset location* map accuracy, *legibility* and currency
- *Closed loop* feedback from field observations to continuously improve data
- *Simplify hardware* technology in vehicle and with crew
- *User interface* improvements (voice input, bar code for data capture)
- Provide better *management tools* for process overview and status
Macro Technology Trends

- Reality Capture
- Cloud Data
- Infinite Computing
- Digital to Analog
- Network Effect
Technology Portfolio

- **Software**
  - 3D Intelligent Model (BIM)
  - Reality Capture
  - Augmented Reality
  - Cloud

- **Hardware**
  - Portable Computing
  - Hand-held GPS
Recommendation Timeline and Insights

- **Immediate - 2 years**
  - Current COTS Product Solutions

- **2-3 years**
  - Medium Term

- **3-5 years**
  - Long Term

- **Strategic Direction & Future Vision**
Technology Adoption Roadmap

- **Late Majority**
- **Early Majority**
- **Early Adopters**

- **3D BIM**
- **Cloud Data & Services**
- **Reality Capture**
- **Augmented Reality**

- Immediate Technology Planning Recommendation
- Longer Term Technology Prototype and Research Recommendation

2013 - 2018
Utility Vision

By 2020, leading utilities will have a complete, accurate, and dynamic 3D model of their infrastructure, including overhead and underground facilities, related equipment and parts, and mobile assets.
3D Visualization to *create and share models of proposed projects*
Example of Customer/Stakeholder Engagement

San Francisco Better Market Street Project…
3D Model and Reality Capture

Current Situation

- Field crews record asset data (Locate & Mark process)
- However data is not consistently re-used and does not become part of the model
# Reality Computing

<table>
<thead>
<tr>
<th>REALITY COMPUTING</th>
</tr>
</thead>
<tbody>
<tr>
<td>REALITY CAPTURE</td>
</tr>
<tr>
<td>Scanning (laser, etc.)</td>
</tr>
<tr>
<td>Photogrammetry</td>
</tr>
<tr>
<td>Range sensors, RGB-D</td>
</tr>
<tr>
<td>Point survey (total station)</td>
</tr>
<tr>
<td>Material capture (BRDS)</td>
</tr>
<tr>
<td><strong>Processing (ReCap)</strong></td>
</tr>
</tbody>
</table>

- **Reality Capture**
  - Scanning (laser, etc.)
  - Photogrammetry
  - Range sensors, RGB-D
  - Point survey (total station)
  - Material capture (BRDS)
  - Processing (ReCap)

- **Reality Modeling and Analysis**
  - Infraworks
  - Meshmixer
  - ReForm
  - Memento
  - Change over time
  - Author → Edit

- **Reality Delivery**
  - 3D printing
  - Computer-aided machining
  - Augmented reality
  - Direct projection (total station)
Current Limitations | Hand-held GPS Accuracy

- Hand-held GPS accuracy today limited to +/- 15 ft. accuracy
- Accuracy requirements for asset location assumed < 1ft
- 1cm accuracy achievable
- GPS survey accuracy requires multiple readings over extended time period
- Corrections required for atmosphere and other factors
- Hand-held survey accuracy and speed improving rapidly over next 3-5 years
- A technology to monitor for integration with field data devices
Hardware is catching up
Augmented Reality – Emerging Technology

Opportunity
Use visualization and augmented reality tools to provide rich contextual information at the point of work

- Create complete model with utility infrastructure and building data
- 3D subsurface views with classification by age, size, inspection results
- Field views of issues and mitigations including planned replacements and construction impacts

Augmented Reality (AR) will become the user interface of the future for field focused design, operations and asset management solutions
3D Visualization and Augmented Reality Strategy

City of Las Vegas 3D Infrastructure Capture Project
Technology Adoption Roadmap

- Immediate Technology Planning Recommendation
  - 3D BIM
  - Cloud Data & Services
  - Reality Capture
  - Augmented Reality

- Technology Adoption Phases:
  - Early Adopters
  - Early Majority
  - Late Majority

- Timeline:
  - 2013
  - 2014
  - 2015
  - 2016
  - 2017
  - 2018

- Longer Term Technology Prototype and Research Recommendation
Mobile Field Applications

Opportunity

Use Autodesk® BIM 360™ Field software to combine mobile technologies at the point of field work with cloud-based collaboration and reporting.

- Intuitive iPad user interface design
- Access maps and technical drawings
- Enables one-time data entry at the point-of-inspection
- Note issues during a field inspections using markers on plans
- Faster access for all stakeholders to the most up-to-date field information
- Web-based and accessible on any device
- Real-time data – dashboards & email with drill-down capabilities
- Scan a barcode to look up equipment (ie meter)
- Voice input and recognition for “hands free” operation
Key Features

Web

- Web-based-accessible on any device
- Available to all stakeholders... both in field and in the office

Mobile

- iPad application, phone – and email
- Syncs with BIM 360 Field Web data
- NO connectivity required

Reports

- Web-based-Accessible on any device
- Real-time data – dashboards & email with drill-down capabilities

Field BIM

- Incorporate field data into your model
- Supports iPad viewing of BIM models & object data online
Field Management Website
BIM 360 | Integrating with Scheduling Services

Cloud Architecture

3rd Party Scheduling

XML Web Services

Internet

BIM 360 Field User

BIM 360 Hosted Services

Internet

XML Web Services

Business Rules

Autodesk 360

Scheduling Workbench

BIM 360 Dashboard

XML Web Services

XYZ Utility

XML Web Services

Autodesk University 2013
The next generation alternative

Cloud-based, zero deployment

Accessible on any device

Up and running in minutes, not months
Conclusions

- A number of advanced technologies are available to transform mobile technology tools for field personnel.

- Planners should consider the rapid pace of technological advancement to begin to plan 1-3 year timeline for production system deployments.

- The Cloud is well suited for rapid deployment and support of utility mobile solutions and is available today for immediate adoption.

- Reality Capture and Augmented Reality (AR) are the key technology trends that will transform mobile field worker solutions in asset intensive industries...will become the “user interface” for applications.