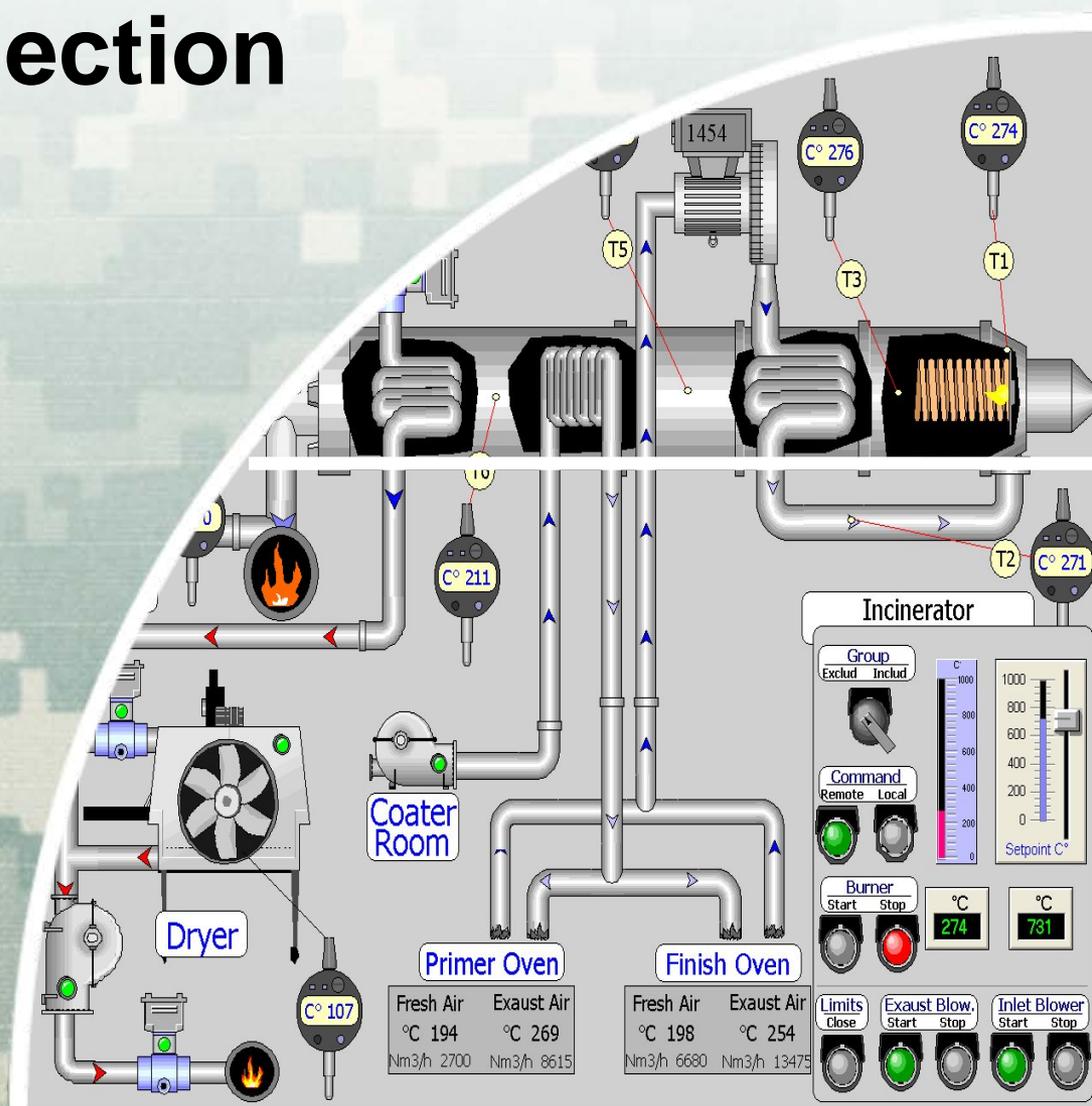


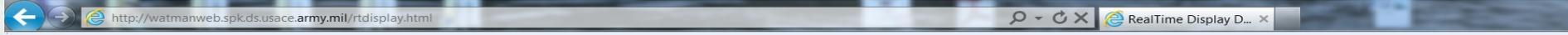
# A HEADS UP: IT Security & Hydro-Met Data Collection



**Peter Arpin**  
Data Collection Team Lead  
Sacramento District  
Nov 5, 2015



# Real Time Data Acquisition



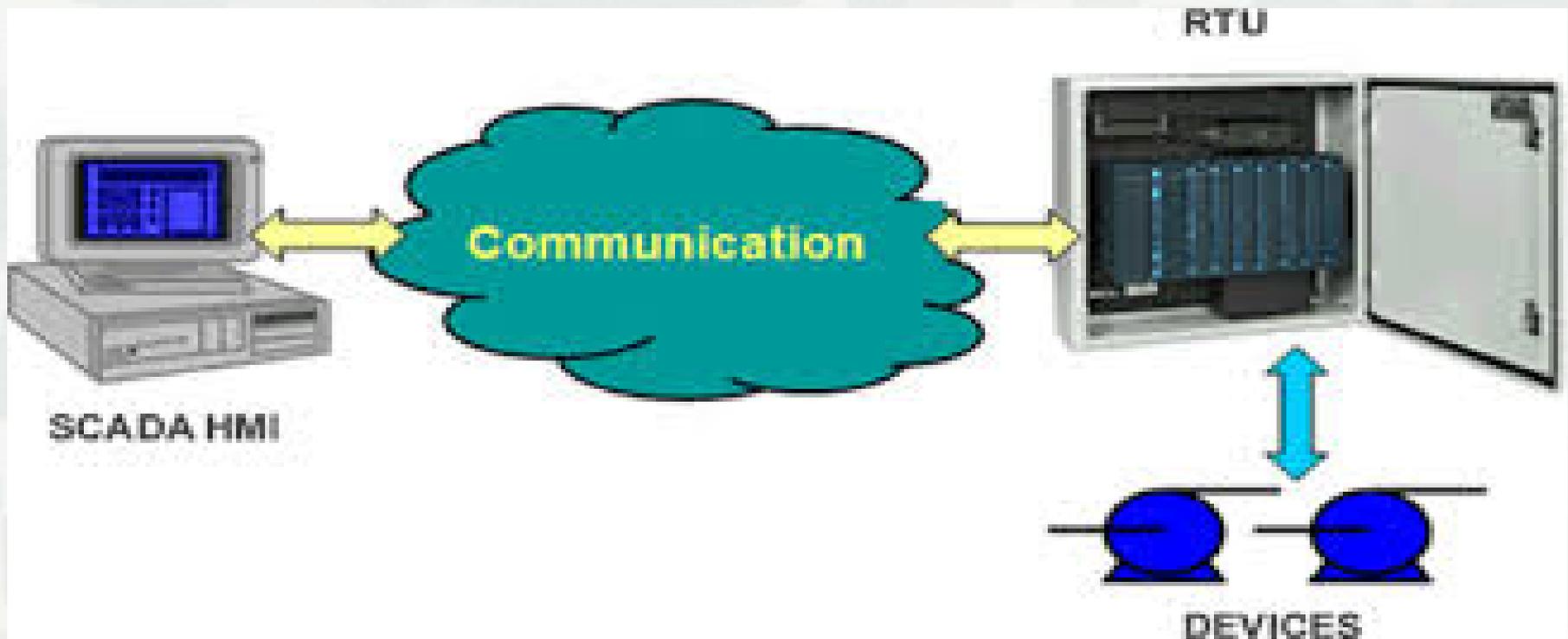
| Farmington  |  | Black Butte  |   | Terminus  |  | Pine Flat  |   |
|---|--|--|---|---|--|--|---|
| <b>Pool</b><br>Storage (acre-ft)<br><b>152</b><br>09/11/2014 16:39:12<br>Elevation (ft)<br><b>123.81</b><br>09/11/2014 16:39:12   | <b>Littlejohn Cr</b><br>Stage (ft)<br><b>6.58</b><br>09/11/2014 16:41:02<br>Flow (cfs)<br><b>53</b><br>09/11/2014 16:41:02   | <b>Pool</b><br>Storage (acre-ft)<br><b>41354</b><br>09/11/2014 16:41:20<br>Elevation (ft)<br><b>444.82</b><br>09/11/2014 16:41:20  | <b>Outflow</b><br>Stage (ft)<br><b>2.91</b><br>09/11/2014 16:41:20<br>Flow (cfs)<br><b>85</b><br>09/11/2014 16:41:20  | <b>Pool</b><br>Storage (acre-ft)<br><b>18719</b><br>09/11/2014 16:41:19<br>Elevation (ft)<br><b>597.96</b><br>09/11/2014 16:41:19 | <b>Outflow</b><br>Stage (ft)<br><b>0.99</b><br>09/11/2014 16:41:23<br>Flow (cfs)<br><b>45</b><br>09/11/2014 16:41:23 | <b>Pool</b><br>Storage (acre-ft)<br><b>115847</b><br>09/11/2014 16:41:12<br>Elevation (ft)<br><b>721.29</b><br>09/11/2014 16:41:12 | <b>Outflow</b><br>Stage (ft)<br><b>2.47</b><br>09/11/2014 16:41:13<br>Flow (cfs)<br><b>367</b><br>09/11/2014 16:40:53 |
| <b>Rock Creek</b><br>Stage (ft)<br><b>4.15</b><br>09/11/2014 16:39:00<br>Flow (cfs)<br><b>116</b><br>09/11/2014 16:39:00          | <b>Stockton East Gauges</b><br>Canal Flow (cfs)<br><b>0</b><br>09/11/2014 16:41:24<br>Forebay Stage (ft)<br><b>0</b><br>09/11/2014 16:41:17<br>North Gate (%)<br><b>0</b><br>09/11/2014 16:41:05<br>South Gate State (tri-state)<br><b>CLOSED</b><br>09/11/2014 16:41:25 | <b>South Diversion</b><br>Stage (ft)<br><b>3.77</b><br>09/11/2014 16:41:22<br>Flow (cfs)<br><b>175</b><br>09/11/2014 16:41:22      |   | <b>Lemon Cove</b><br>Stage (ft)<br><b>1.64</b><br>09/11/2014 16:41:23<br>Flow (cfs)<br><b>9</b><br>09/11/2014 16:41:23            | <b>Foothill</b><br>Stage (ft)<br><b>0.8</b><br>09/11/2014 16:41:23<br>Flow (cfs)<br><b>13</b><br>09/11/2014 16:41:23 | <b>Mill Creek</b><br>Stage (ft)<br><b>1.22</b><br>09/11/2014 16:33:11<br>Flow (cfs)<br><b>0</b><br>09/11/2014 16:33:11             |   |
|   |  | <b>Isabella</b>  |   | <b>Success</b>  |  | <b>Martis Creek</b>  |   |
|   |  | <b>Pool</b><br>Storage (acre-ft)<br><b>51959</b><br>09/11/2014 16:41:24<br>Elevation (ft)<br><b>2532.41</b><br>09/11/2014 16:41:24 | <b>Outflow</b><br>Stage (ft)<br><b>4.97</b><br>09/11/2014 16:41:24<br>Flow (cfs)<br><b>122</b><br>09/11/2014 16:41:24 | <b>Pool</b><br>Storage (acre-ft)<br><b>4630</b><br>09/11/2014 16:41:21<br>Elevation (ft)<br><b>581.34</b><br>09/11/2014 16:41:21  | <b>Outflow</b><br>Stage (ft)<br><b>2.91</b><br>09/11/2014 16:41:05<br>Flow (cfs)<br><b>36</b><br>09/11/2014 16:41:05 | <b>Pool</b><br>Storage 0<br><b>812</b><br>09/11/2014 16:41:02<br>Elevation (ft)<br><b>5780.59</b><br>09/11/2014 16:41:02           | <b>Outflow</b><br>Stage (ft)<br><b>2.32</b><br>09/11/2014 16:40:34<br>Flow (cfs)<br><b>2</b><br>09/11/2014 16:40:34   |
|   |  | <b>Borel Canal</b>   |   | <b>Pioneer Ditch</b>  |  | <b>New Hogan</b>   |   |
|   |  | <b>Stage (ft)</b><br><b>-0.25</b><br>09/11/2014 16:41:24<br><b>Flow (cfs)</b><br><b>0</b><br>09/11/2014 16:41:24                   |   | <b>Stage (ft)</b><br><b>0.04</b><br>09/11/2014 16:41:02<br><b>Flow (cfs)</b><br><b>0</b><br>09/11/2014 16:41:02                   |  | <b>Pool</b><br>Storage 0<br><b>48448</b><br>09/11/2014 16:41:21<br>Elevation (ft)<br><b>617.49</b><br>09/11/2014 16:41:21          | <b>Outflow</b><br>Stage (ft)<br><b>1.65</b><br>09/11/2014 16:41:22<br>Flow (cfs)<br><b>224</b><br>09/11/2014 16:41:22 |
| <b>Coyote</b>   |  | <b>Buchanan</b>  |   | <b>Hidden</b>   |  | <b>Warm Springs</b>  |   |
| <b>Pool</b><br>Storage (acre-ft)<br><b>30987</b><br>09/11/2014 16:41:20<br>Elevation (ft)<br><b>711.94</b><br>09/11/2014 16:41:20 | <b>Outflow</b><br>Stage (ft)<br><b>1.63</b><br>09/11/2014 16:41:20<br>Flow (cfs)<br><b>99</b><br>09/11/2014 16:41:20   | <b>Pool</b><br>Storage (acre-ft)<br><b>12073</b><br>09/11/2014 16:41:25<br>Elevation (ft)<br><b>469.79</b><br>09/11/2014 16:41:25  | <b>Outflow</b><br>Stage (ft)<br><b>0</b><br>09/11/2014 16:41:08<br>Flow (cfs)<br><b>0</b><br>09/11/2014 16:41:08      | <b>Pool</b><br>Storage (acre-ft)<br><b>5107</b><br>09/11/2014 16:41:20<br>Elevation (ft)<br><b>448.48</b><br>09/11/2014 16:41:20  | <b>Outflow</b><br>Stage (ft)<br><b>0.71</b><br>09/11/2014 16:41:14<br>Flow (cfs)<br><b>0</b><br>09/11/2014 16:41:14  | <b>Pool</b><br>Storage (acre-ft)<br><b>152033</b><br>09/11/2014 16:41:24<br>Elevation (ft)<br><b>410.02</b><br>09/11/2014 16:41:24 | <b>Outflow</b><br>Stage (ft)<br><b>4.57</b><br>09/11/2014 16:41:24<br>Flow (cfs)<br><b>132</b><br>09/11/2014 16:41:24 |

CLOCK



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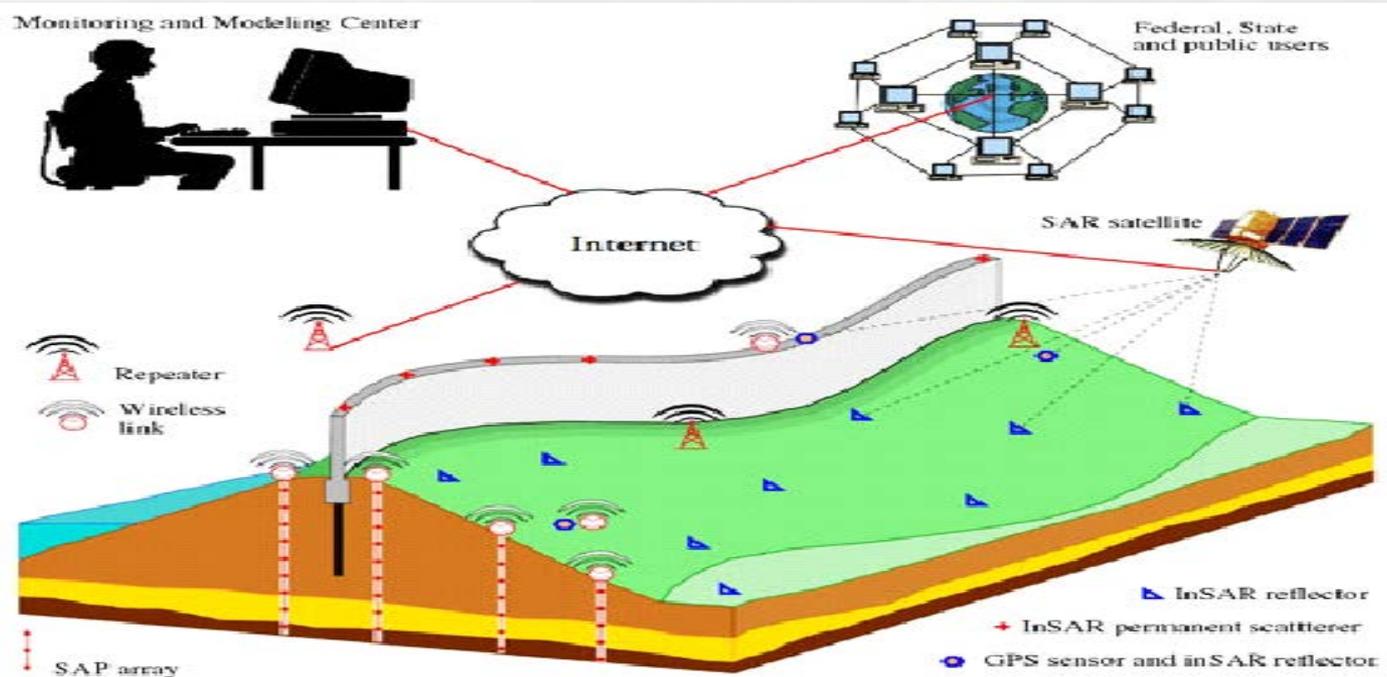
# Modern Data Acquisition uses Internet Protocol (IP) Networks



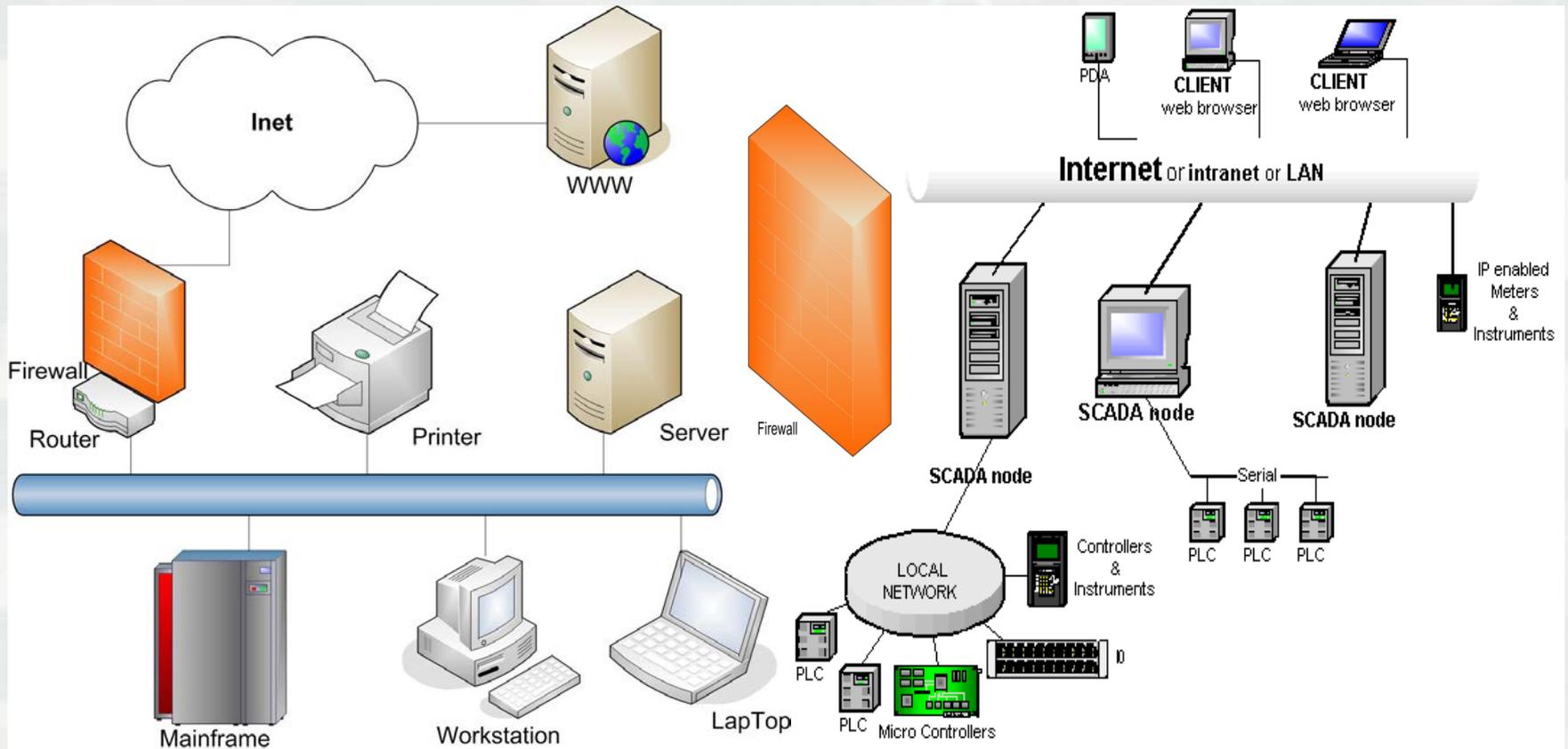
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# Advantages to Networked Data Collection

- Widely Distributed Real Time Information
- Remote Configuration/Troubleshooting
- Reduced Staffing Requirements
- Machine to Machine Communications



# Data Collection & Business Networks use similar devices and protocols



# Historically automated Data Collection was considered a small part of SCADA

- **SCADA: “Supervisory Control And Data Acquisition”**



# Originally SCADA only existed in

- Heavy Industry – PetroChemical, Fabrication, Etc.
- Electric Power – Generation & Distribution
- Pipeline Transport – Oil & Gas, Water & Sewage



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# SCADA is now considered a subset of Industrial Control Systems (ICS)

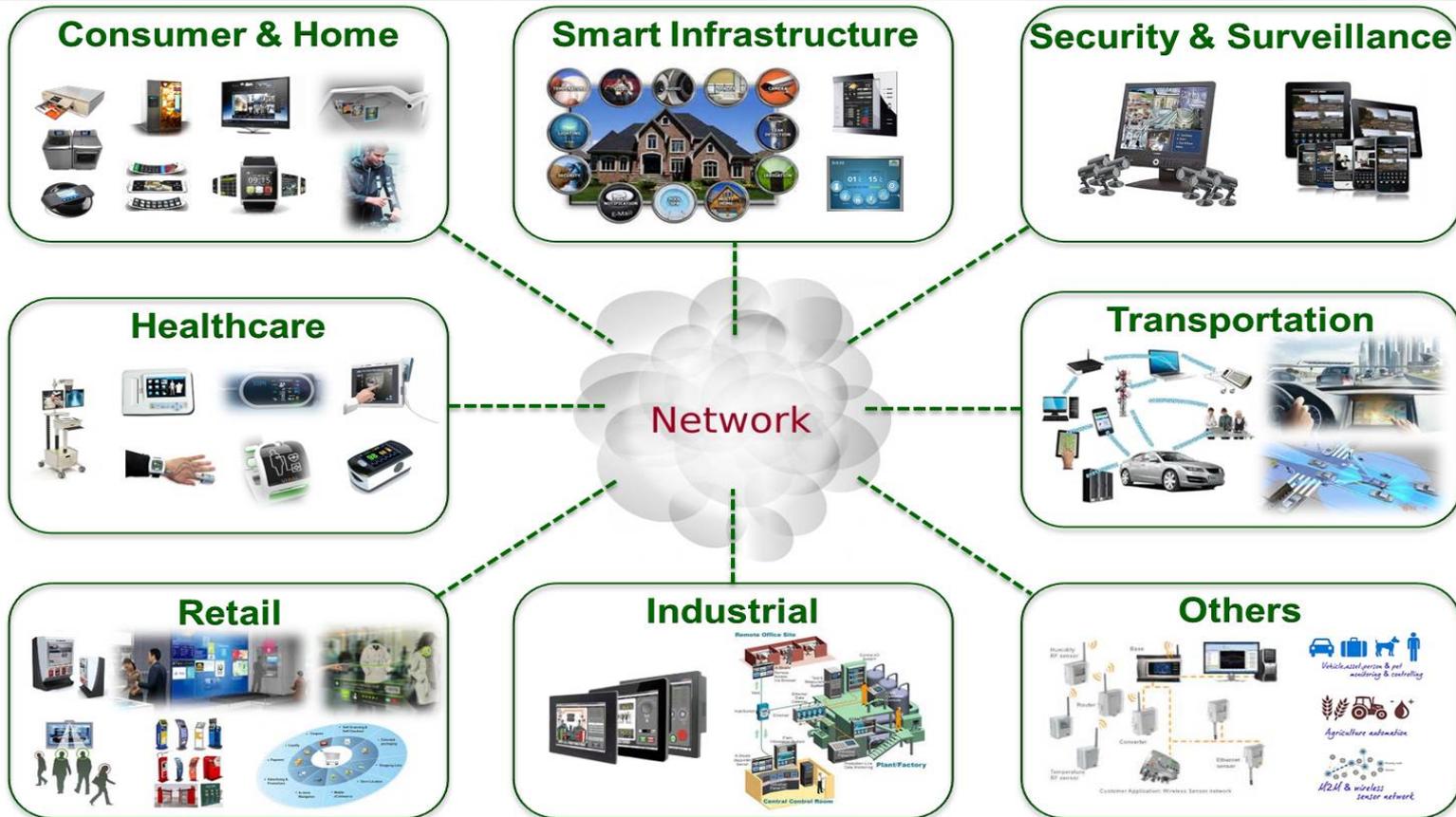
Definition of an Industrial Control System...

*“... any system that gathers information on an industrial system or process and/or modifies, regulates or manages the system or process...”*



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# ICS are EVERYWHERE

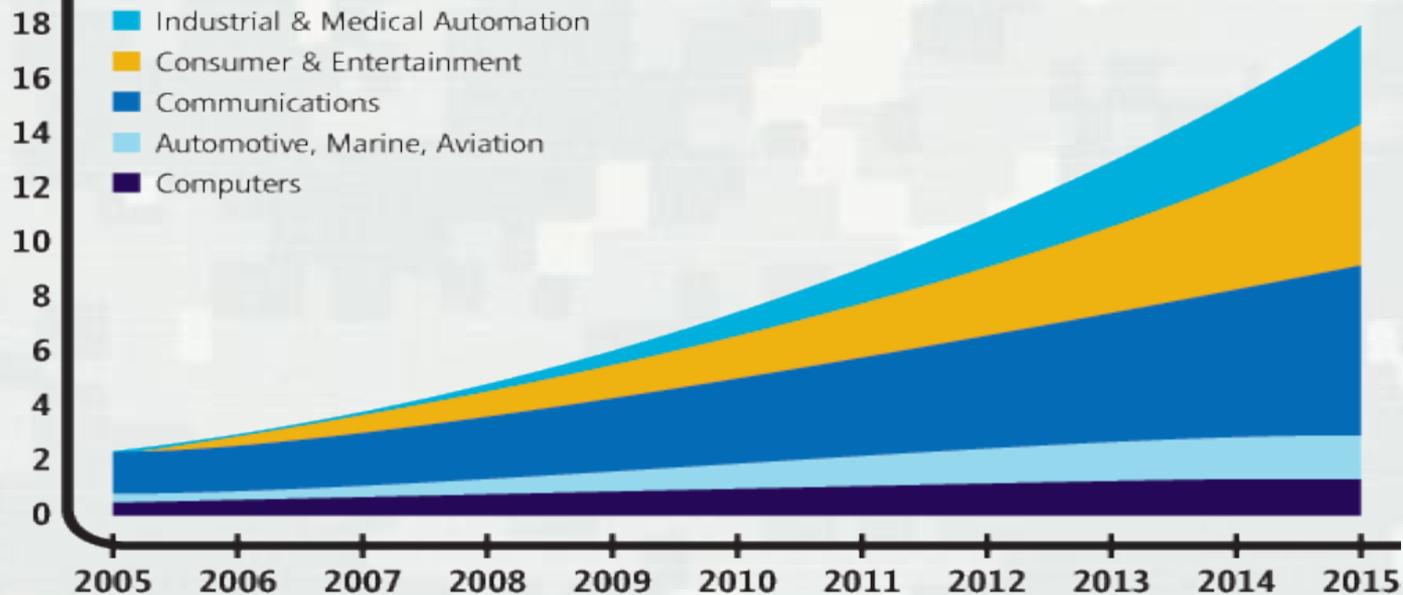


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Number of Devices (in billions)



Source: John Gantz, The Embedded Internet, Methodology and Findings, IDC, January 2009

**15B**

CONNECTED DEVICES IN 2015



**40B**

CONNECTED DEVICES BY 2020



 = 1B DEVICES



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# Current “ICS” in the Sacramento District, USACE

- Hydro-Met Data Collection- *120+ Networked Data Loggers*



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# Additional “ICS” in the Sacramento District

- Automated Security Systems – 3-5 *Dams*
- Dam Safety/Geotech Sensors – 100++
- Automated Dam Gates – 4 *Dams*
- Automated Water Quality – 2++
- Multi Purpose Cameras – 100++
- Networked Solar Arrays – 10+



# Other ICS in USACE

- Hydro-Electric Generation
- Lock and Dam Controls
- Facility Management
- ???



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# Future Corps ICS Applications?

- Facility Security
- Drone Operation (ROV, Levee Flights, HazMat)
- Widespread Real-Time Environment Monitoring
- Human Sensing (Confined Space, Remote Duty)
- Facility Energy Management
- Levee Monitoring/Water Routing
- Ubiquitous Wireless Comm.
- Smart Vehicles
- Smart Dams??

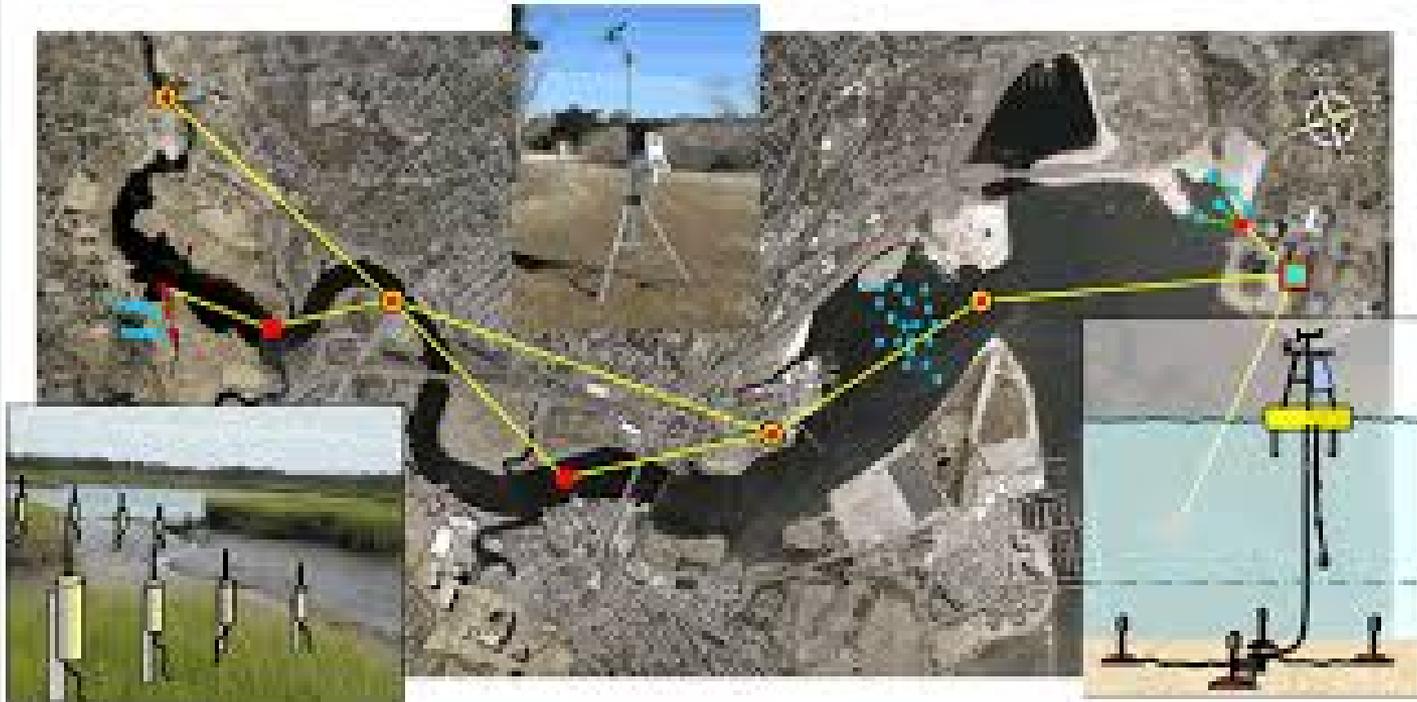


(Gage -> Dam 1 -> Levee -> Dam 1 -> Dam 2)



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# A Limitless Future!



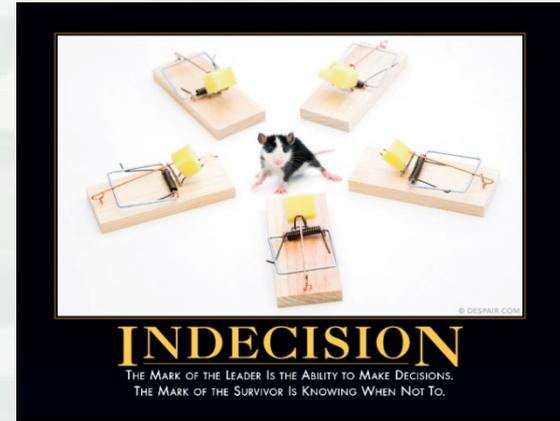
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# CYBER WAR – The Nightmare Scenario



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# Typical IT Dept. Defense Plan



- Most IT Departments are ill equipped to manage ICS due little incentive for innovation, a lack of mission awareness, a lack of special skill sets, a lack of accountability, Byzantine support process, etc. etc.



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# Operational Requirements: Business vs. ICS Networks

|                      | Business | ICS      |
|----------------------|----------|----------|
| Availability         | Moderate | High     |
| Data Confidentiality | High     | Low      |
| Data Integrity       | Moderate | Moderate |
| Life/Property Risk   | Low      | High     |

Requirement Differences require  
Different Management Strategies



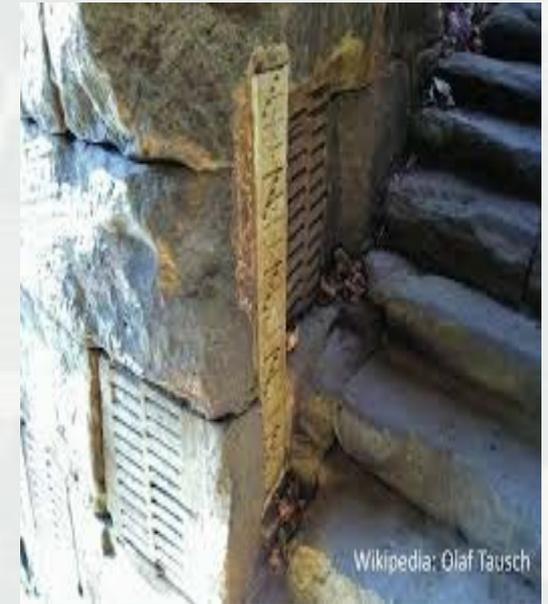
# Summary

- The Corps currently has hundreds of ICS devices in place
- Networked ICS Devices are Growing Exponentially
- They Present too many Advantages to Ignore
- They Present too many Risks to Ignore

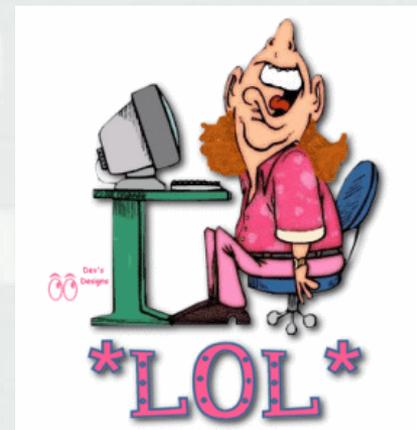


# Conclusion

21<sup>st</sup> Century Organizations can't Survive with 10<sup>th</sup> Century BC Tech.



- The Data Collection agencies must develop **COMPEHENSIVE, RESPONSIVE, COST EFFECTIVE** Strategies for managing ICS.
- Relying on traditional IT Departments is rarely satisfactory.



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# We can't Put the Genie Back...



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# So what Can We Do?



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