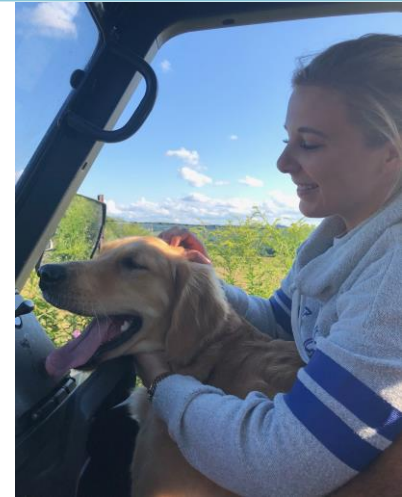


Steve Frangione



MARKET DEVELOPMENT MANAGER – MONITORING & CONTROLS
XYLEM

BS - ELECTRICAL ENGINEERING
CHARLOTTE, NC



THE IMPACT OF SCADA

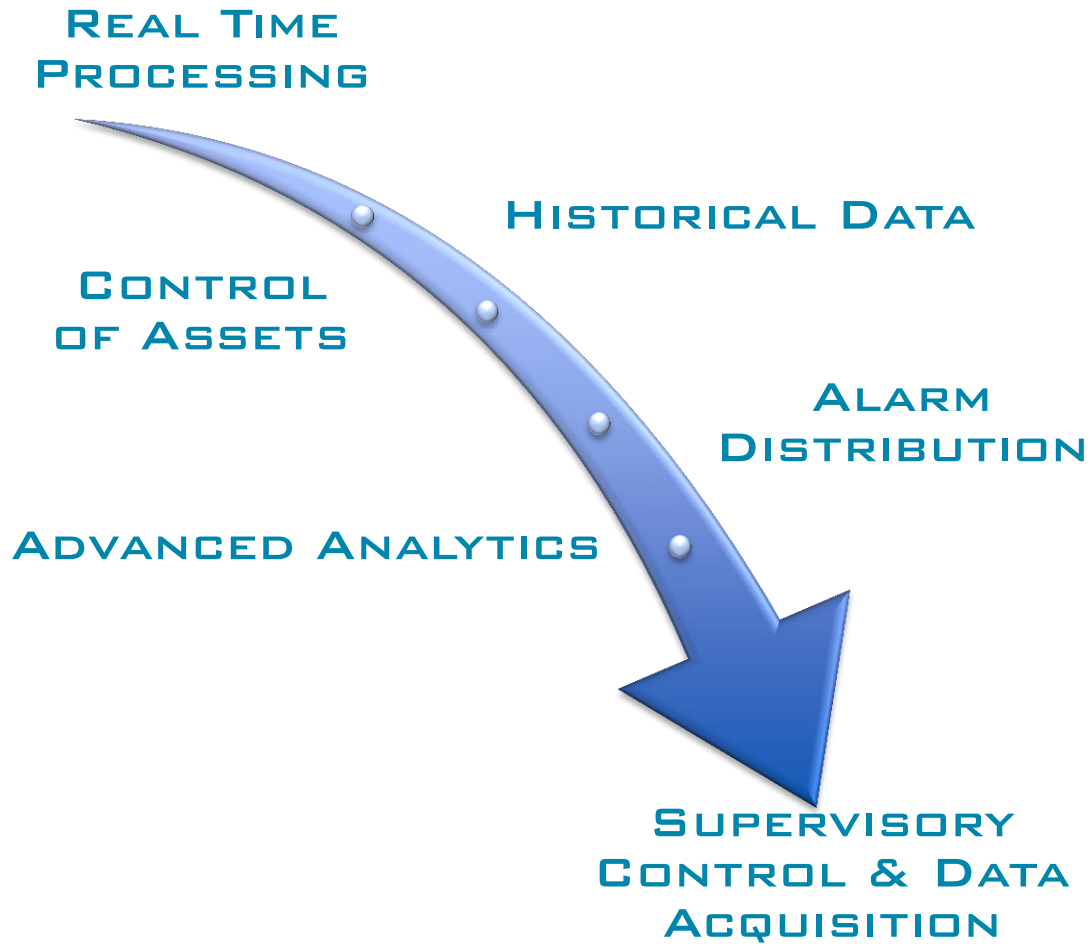


AGENDA

- ✓ INTRODUCTION TO SCADA
- ✓ MODERN APPLICATIONS
- ✓ IMPACT OF SCADA IN THE WASTE WATER INDUSTRY
- ✓ BASIC ARCHITECTURE & DESIGN
- ✓ COMMUNICATIONS
- ✓ SECURITY
- ✓ BENEFITS



WHAT IS SCADA?



MODERN EVERYDAY APPLICATIONS

IRRIGATION SYSTEM



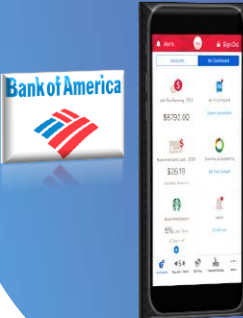
SMART HOMES



NANNY CAM



ONLINE BANKING



VEHICLE



BABY MONITOR

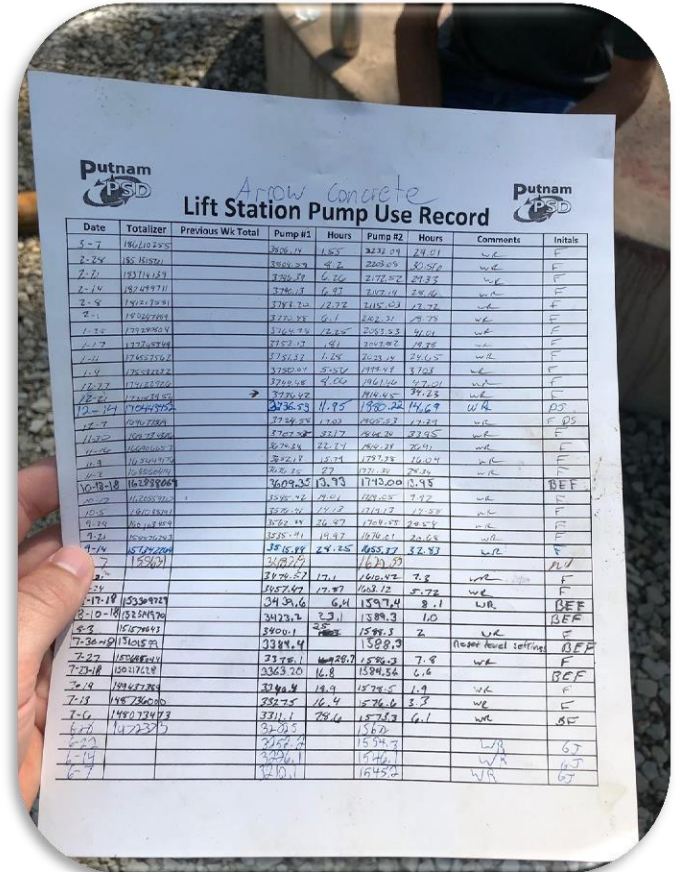


INDUSTRIES

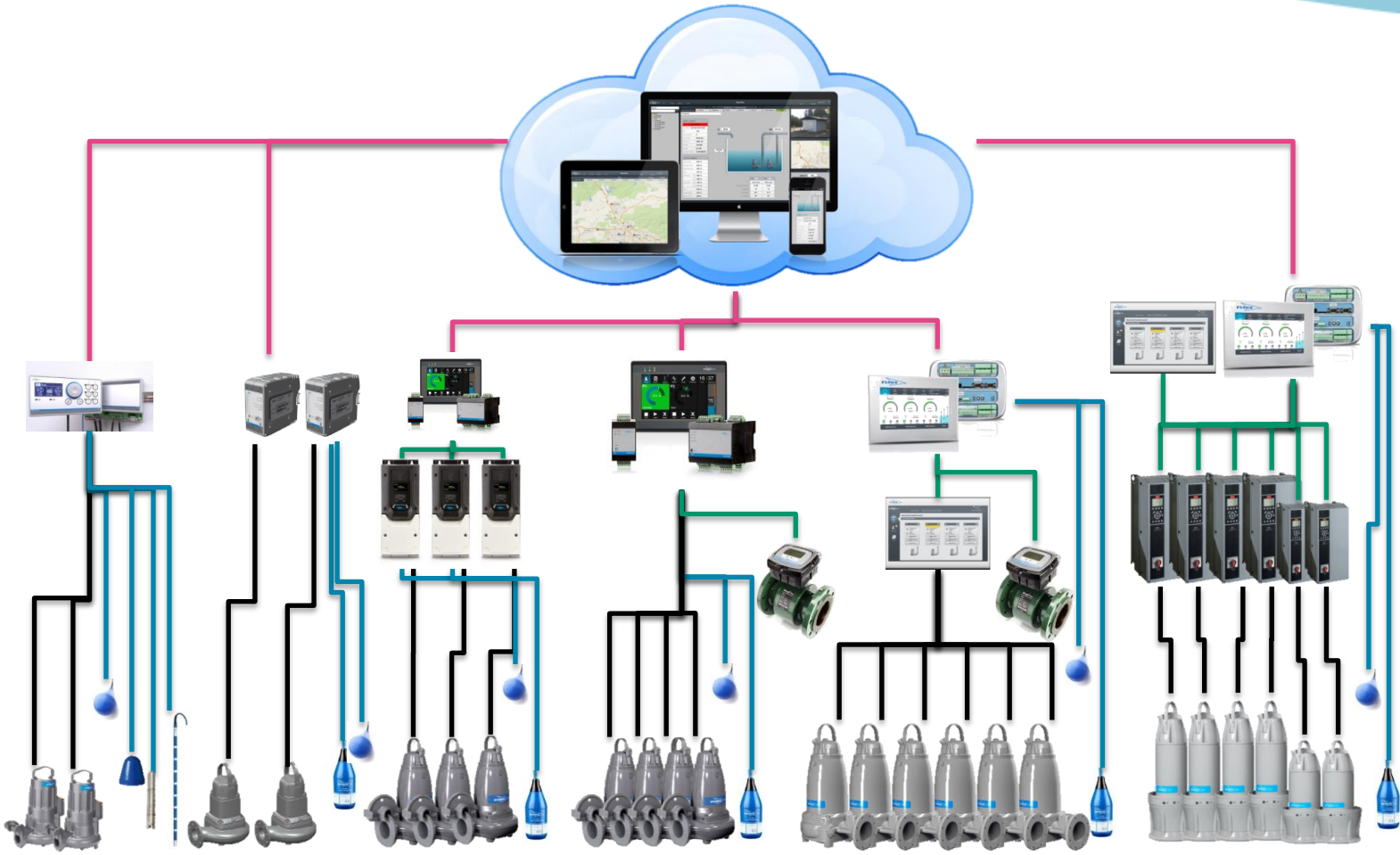


PRIOR TO ADVANCED REMOTE MONITORING

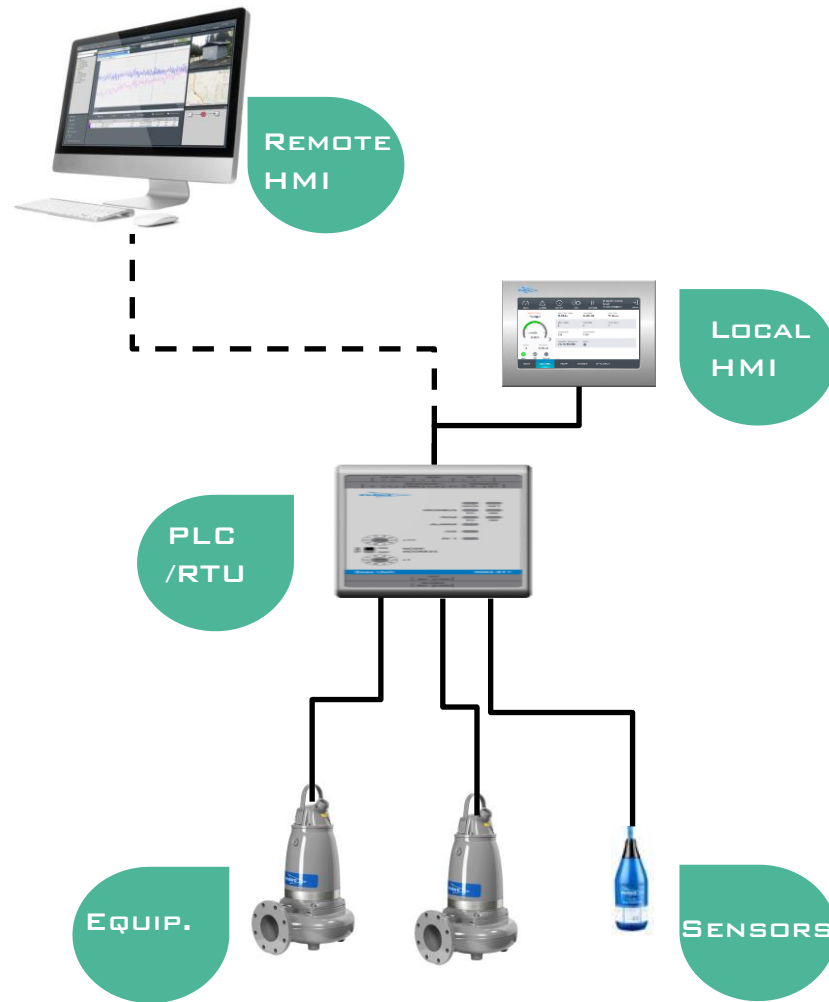
- ✓ MANUAL DATA ENTRY
- ✓ VISIT SITES DAILY
- ✓ LIMITED VISIBILITY
- ✓ LACK OF ANALYSIS



TODAYS WATER & WASTE WATER CONNECTIVITY



SYSTEM OVERVIEW



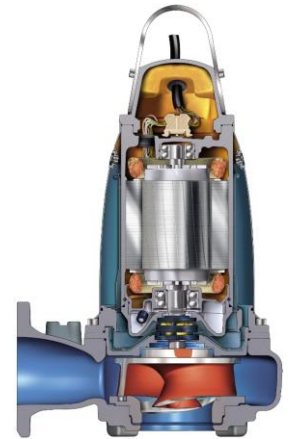
WHAT DO WE MONITOR?



SCADA

PLC/RTU

- Level
- Power
- Current
- Leakage
- Temp
- Flow
- Speed



COMMUNICATION

Wired Communication

Metal wire, fiber

- Locally in the panel



RS232



RS485



RJ45
Ethernet



Wireless Communication

Radio, GSM, GPRS, 3G, 4G

- Remotely from panel to SCADA



Modem / Network



PROTOCOL COMMUNICATION LANGUAGE

Protocols

Modbus TCP



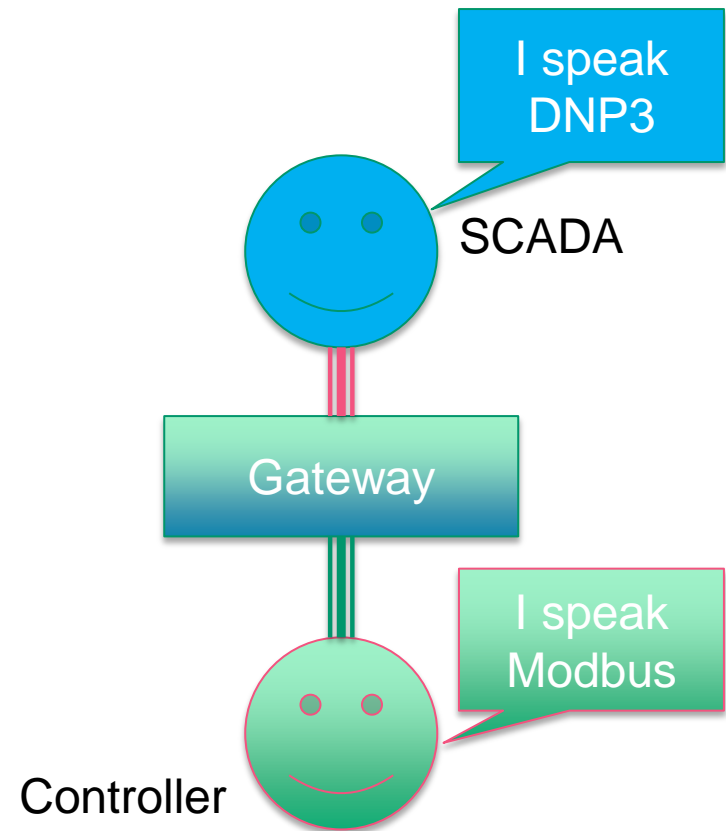
Modbus RTU



AquaCom



DNP-3



A LOOK AT PROTOCOLS - DEVELOPMENT

- Two main formats...

Polled



1970

1980

1990

2000

Event Driven



Present

xylem
Let's Solve Water

A look at Protocols - Polled

- Polled Sequence... 1, 2, 3, 4...
- Poor Detail
- Missed Events
- Slow response



A LOOK AT PROTOCOLS – EVENT BASED

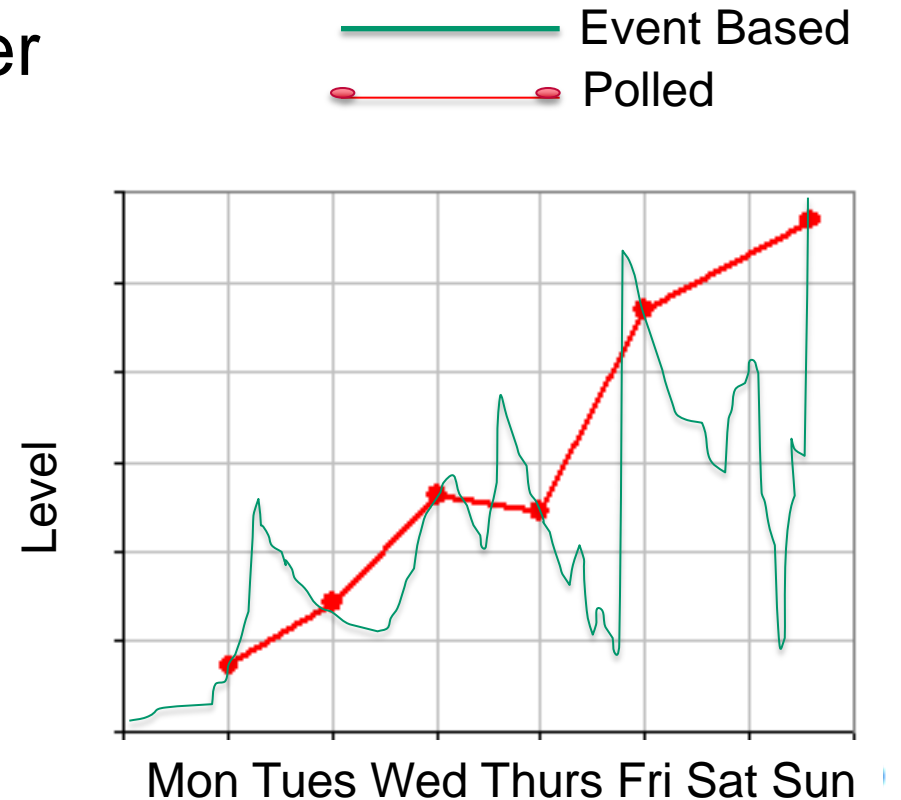
- Each participant speaks when they have news
- Excellent Detail
- Efficient Live Data
- Quick Health check



I hear you
Number 7
& Number
5!

A LOOK AT PROTOCOLS – IMPORTANCE?

- Better detail means better diagnostics
- Time & Date Stamped
- Higher Reliability
- Excellent Detail
- Live Data
- Reduced Costs



A LOOK AT PROTOCOLS – POPULAR CHOICES

Polled

- ModBus
- DF1
- ProfiBus

Event based

- DNP3.0
- OPC
- IEC
- MQTT
- CoAP





SECURITY

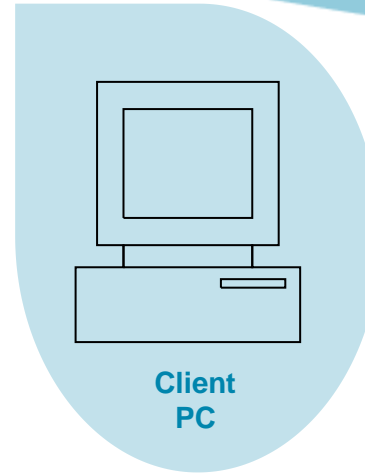
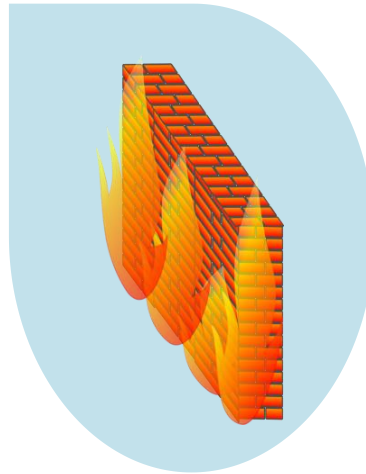
- ✓ SECURE LOCATION
- ✓ USER AUTHENTICATION
- ✓ LEVELS OF ACCESS
- ✓ FIREWALL
- ✓ VPN

FIREWALL

162.21.26.4

54.21.66.20

40.55.130.65



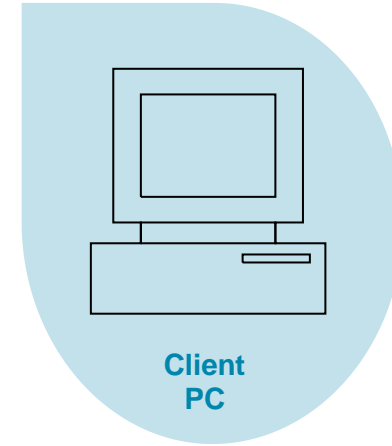
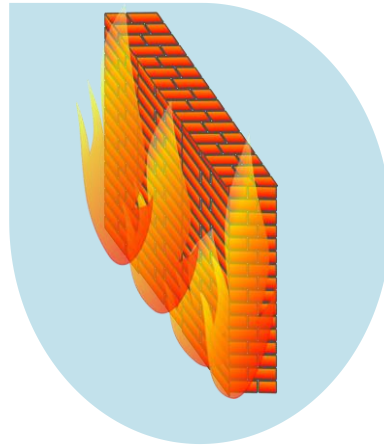
Permission	IP Address	Protocol	Port
ALLOW	162.21.26.4	TCP	80
ALLOW	54.21.66.200	TCP	80
DENY	40.55.130.65	TCP	80

FIREWALL...

80

120

36



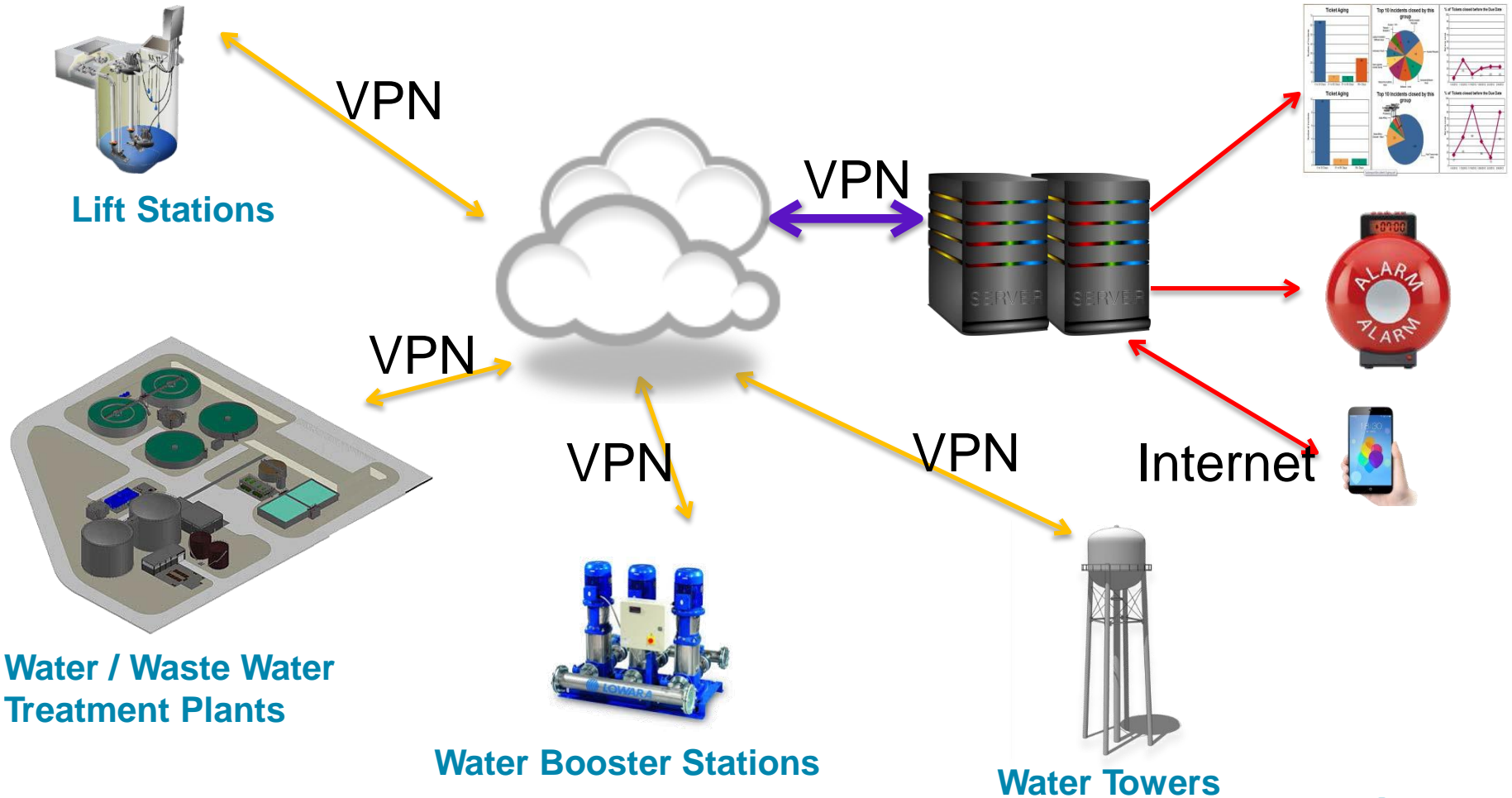
Permission	IP Address	Protocol	Port
ALLOW	162.21.26.4	TCP	80
DENY	54.21.66.200	TCP	120
ALLOW	40.55.130.65	TCP	36

VIRTUAL PRIVATE NETWORK (VPN)



- ✓ EACH DEVICE CONNECTED TO THE INTERNET HAS AN IP ADDRESS.
- ✓ WHEN ACCESSING A WEB PAGE YOUR IP ADDRESS IS COLLECTED BY THE WEB SERVER.
- ✓ WHEN ON A PUBLIC NETWORK YOUR DEVICE IS EXPOSED TO HACKERS AND OTHER MALICIOUS TRAFFIC.

VPN...



Water / Waste Water Treatment Plants

Water Booster Stations

Water Towers

SCADA EXAMPLES

REAL TIME INFORMATION AND CONTROL

PumpView 3 powered by VTScada US\W\Ixonixia 9:05 PM Feb 3 cstowe

US\W\Ixonixia Sort by Name

- Autumn Ridge LS
- Division LS
- Industrial LS
- La Salle LS
- Lac La Belle LS
- Madison LS
- Marietta LS
- NewRosterTag
- North LS
- Plant Dosing Station
- Plant Pump Station
- Preserve LS

Industrial LS

Powered by Dark Sky

Wind Speed 11.1 mph

33 °F

Precipitation Intensity 0.00 in/h

Comms

AB: 210 VAC
BC: 216 VAC
CA: 212 VAC

Inflow: 24 GPM
Outflow: 490 GPM

2.1 ft

Pump 1 (Running)			Pump 2 (Next To Run)		
A	B	C	A	B	C
20.2 A	21.4 A	21.5 A	0.0 A	0.0 A	0.0 A
STARTS: 24605	RUN TIME: 783.1 hr		STARTS: 21032	RUN TIME: 812.9 hr	
Auto	Off	Manual	Auto	Off	Manual

MORE DETAILS MORE DETAILS

Legend

- Invalid Data
- Alarm
- Normal
- Alarm Unacked
- Normal Unacked
- Polling
- Fast Poll
- Comm Error
- Polling Disabled
- Normal

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Update Site Location

FlygtCloud – SCADA Screen Examples

Side by Side Pump Performance Comparison

PumpView³ powered by VTScada

US\W\Ixonixia

9:11 PM Feb 3
cstowe

Sort by Name

Industrial LS

Industrial LS

Powered by Dark Sky

Wind Speed 11.1 mph

33 °F

Precipitation Intensity 0.00 in/h

Comms

AB: 210 VAC
BC: 216 VAC
CA: 212 VAC

Inflow: 24 GPM
Outflow: 490 GPM

1.5 ft

	P1	P2
Starts Yesterday	17.0	17.0
Starts Last Week	129.0	136.0
Starts Last Month	479.0	504.0
Runtime Yesterday	0.6 hr	0.6 hr
Runtime Last Week	4.6 hr	5.0 hr
Runtime Last Month	17.1 hr	18.4 hr
Flow Yesterday	9.4 kGal	8.8 kGal
Flow Last Week	66.4 kGal	68.5 kGal
Flow Last Month	247.6 kGal	256.0 kGal
Energy Yesterday	3.8 kWh	3.7 kWh
Energy Last Week	4.0 kWh	4.2 kWh
Energy Last Month	105.5 kWh	111.1 kWh
Efficiency Yesterday	247184.0 Gal/kWh	238756.0 Gal/kWh
Efficiency Total	207179.0 Gal/kWh	201004.0 Gal/kWh
Specific Energy Yesterday	4.0 kWh/ML	4.2 kWh/ML
Specific Energy Total	4.8 kWh/ML	5.0 kWh/ML

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Update Site Location

Comm Error
Polling Disabled
Normal

LOGGING

Why?

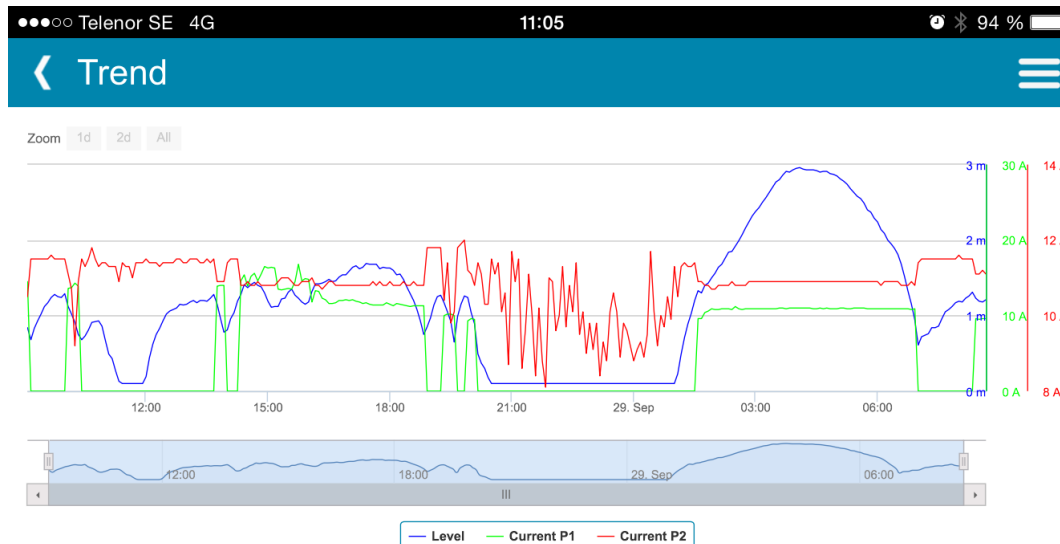
- Station performance
- Fault tracing

What?

- Water Level
- Current
- Alarms

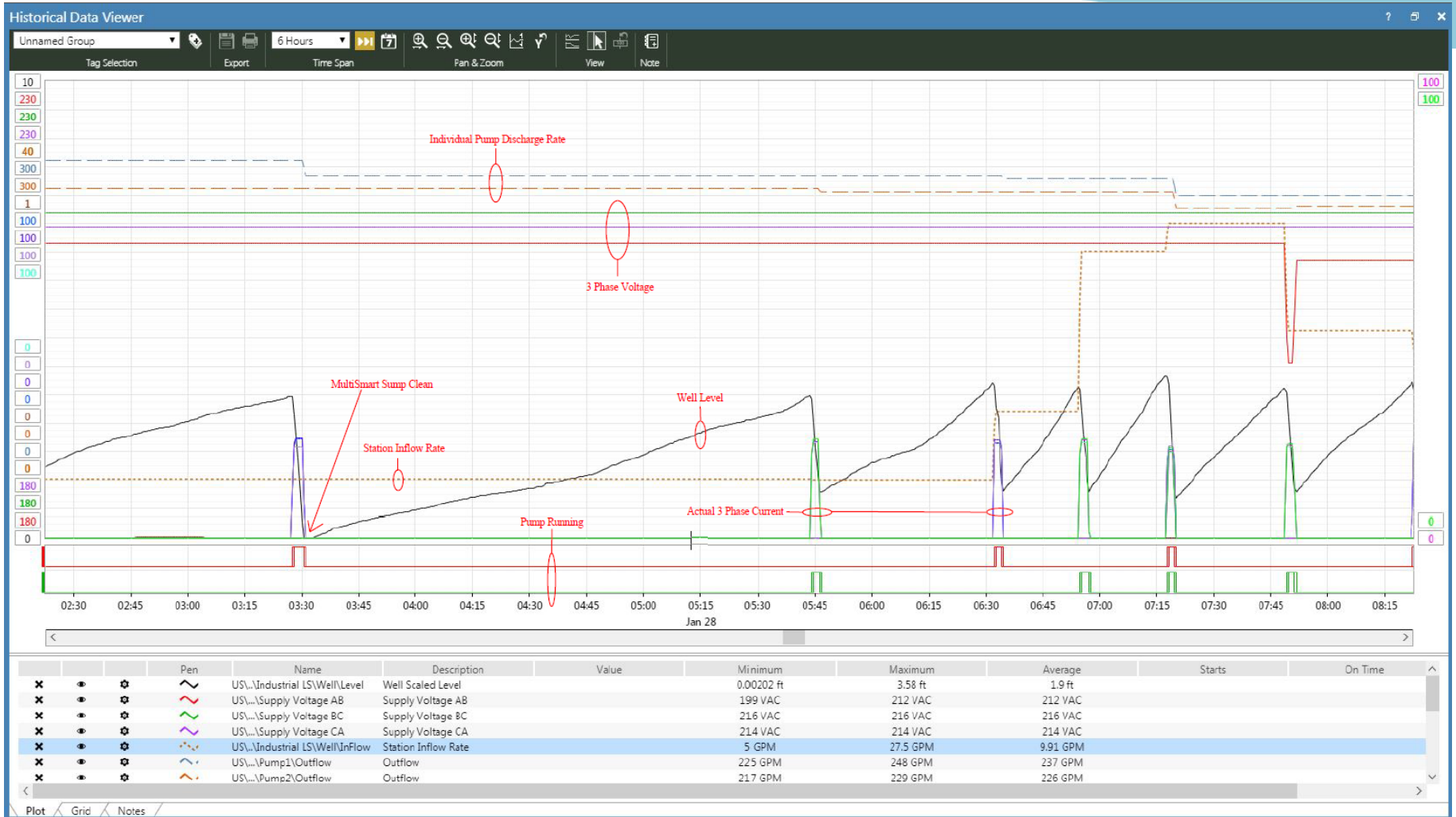
Where?

- Controller: Log Batch
- SCADA: All data




SCADA SCREEN EXAMPLES

HISTORICAL DATA VIEWER (HDV)




REPORTS

EMAILED DAILY AND/OR MONTHLY



**Daily Report
Flow Summary
09-May-19 to 10-May-19**

Site Name	Volume Pumped (kGal)				Average Pump Flow (Gal/min)			Inflow (Gal/min)		
	P1	P2	P3	Station	P1	P2	P3	Peak Date/Time	Peak Value	Average Value
WI - Autumn Ridge	18.596	19.069	0.000	37.665	131	135	0	5/9/2019 8:21	52	0.13
WI - Division LS	65.126	59.981	0.000	125.107	311	393	0	5/9/2019 2:02	137	0.35
WI - Industrial LS	20.973	20.011	0.000	40.984	262	247	0	5/9/2019 8:14	55	0.25
WI - La Salle LS	2.808	2.518	0.000	5.326	87	90	0	5/9/2019 8:52	6	0.09
WI - Lac La Belle LS	39.139	38.810	0.000	77.949	319	320	0	5/9/2019 19:40	138	0.32
WI - Madison LS	0.000	0.105	0.000	0.105	0	45	0	5/9/2019 0:00	0	0.05
WI - Marietta LS	29.236	28.927	0.000	58.163	315	333	0	5/9/2019 8:04	76	0.32
WI - North LS	8.748	9.166	0.000	17.914	216	217	0	5/9/2019 8:39	22	0.22
WI - Plant Dosing Station	125.568	124.372	124.091	374.031	886	916	960	5/9/2019 9:04	348	0.92
WI - Plant Pump Station	119.600	116.139	116.218	351.957	550	608	584	5/9/2019 9:31	406	0.58
WI - Preserve LS	15.608	15.925	0.000	31.533	91	100	0	5/9/2019 7:44	36	0.10
MIN	0.000	0.105	0.000	0.105	0	45	0		0	0.05
MAX	125.568	124.372	124.091	374.031	886	916	960		406	0.92
AVERAGE	40.491	36.252	80.103	93.395	288	284	515		106	0.28
TOTALS	445.402	435.023	240.309	1,120.734	3,169	3,404	1,544		1,275	3.32

Accumulators | Hours Run & Starts | **Flow** | Power and Efficiency | Alarms | Assets | Charts | 

REPORTS

EMAILED DAILY AND/OR MONTHLY



Daily Report
Hours Run and Starts
09-May-19 to 10-May-19

Site Name	Run Time (Hours)								Starts								Average Run Time / Start (min)				Maximum Run Time (min)		
	P1		P2		P3		Station Run		P1		P2		P3		Total Starts		P1	P2	P3	Avg	P1	P2	P3
	2-May	9-May	2-May	9-May	2-May	9-May	2-May	9-May	2-May	9-May	2-May	9-May	2-May	9-May	2-May	9-May	2-May	9-May	2-May	9-May	2-May	9-May	2-May
WI - Autumn Ridge	2.33	2.36	2.27	2.36	0.00	0.00	4.60	4.73	24	24	23	23	0	0	47	47	5.91	6.16	0.00	6.03	7.03	7.04	0.00
WI - Division LS	3.39	3.49	2.49	2.54	0.00	0.00	5.88	6.03	78	77	78	77	0	0	156	154	2.72	1.98	0.00	2.35	3.16	2.36	0.00
WI - Industrial LS	1.19	1.34	1.24	1.35	0.00	0.00	2.43	2.68	30	33	31	33	0	0	61	66	2.43	2.45	0.00	2.44	2.75	2.76	0.00
WI - La Salle LS	0.36	0.54	0.40	0.47	0.00	0.00	0.77	1.01	7	10	8	9	0	0	15	19	3.24	3.12	0.00	3.18	3.44	3.20	0.00
WI - Lac La Belle LS	1.71	2.04	1.76	2.02	0.00	0.00	3.47	4.07	36	42	37	42	0	0	73	84	2.92	2.89	0.00	2.91	3.88	3.59	0.00
WI - Madison LS	0.08	0.00	0.08	0.04	0.00	0.00	0.16	0.04	2	0	2	1	0	0	4	1	0.00	2.33	0.00	2.33	0.00	2.59	0.00
WI - Marietta LS	1.37	1.55	1.31	1.45	0.00	0.00	2.68	3.00	69	76	70	76	0	0	139	152	1.22	1.14	0.00	1.18	1.42	1.27	0.00
WI - North LS	0.49	0.67	0.45	0.70	0.00	0.00	0.93	1.38	14	19	13	20	0	0	27	39	2.13	2.11	0.00	2.12	2.19	2.27	0.00
WI - Plant Dosing Station	1.94	2.36	1.87	2.26	1.97	2.15	5.78	6.78	14	16	14	16	15	15	43	47	8.86	8.49	8.62	8.65	10.03	9.55	9.81
WI - Plant Pump Station	3.14	3.62	2.70	3.18	2.78	3.31	8.61	10.12	65	70	65	70	65	70	195	210	3.10	2.73	2.84	2.89	5.39	5.06	4.90
WI - Preserve LS	2.57	2.85	2.32	2.64	0.00	0.00	4.90	5.50	21	22	21	23	0	0	42	45	7.78	6.89	0.00	7.33	9.42	7.88	0.00

□

SCADA

SUPERVISORY CONTROL AND DATA ACQUISITION



Thank You!



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South East
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