Digital Transformation in Smart Infrastructure

Rashesh Mody
Sr. VP, Head of Monitoring and Control Business
SCOPE: Infrastructure Projects

- Seamless and uninterrupted movement of people, goods, data, natural resources and energy while leveraging best-in-class technology.

Quality of Life
Safe. Reliable. Sustainable
Digital Transformation

Business Operations and Operations Management

- Bringing all dimensions together to make smarter decisions and efficient operations
  - All Physical Systems
  - Lifecycle
  - Engineering
  - Operations
  - Maintenance
  - People Collaboration
  - Processes

- End user satisfaction

Your Digital Transformation: An Execution Roadmap
# Imperatives

Beyond Real-time visibility. Sustainable Innovation through Digitization

## Macro Trends

<table>
<thead>
<tr>
<th>Urbanization – upgrades, expansions</th>
<th>Cost Pressure on big projects</th>
<th>Smart Cities</th>
<th>Cloud/big data infrastructure build-out</th>
<th>Demand for improved experience</th>
</tr>
</thead>
</table>

## Micro Trends

- Many large greenfield capital projects funded by private and public entities
- Modernization and expansion of existing infrastructures due to capacity growth, aging, national initiatives, availability of inexpensive capital
- Resources optimization – energy and water management and reducing operating cost
- Opportunities to leverage IT/OT convergence, asset digitization evolution, cloud platforms, big data, and analytics for capital and operational efficiency
- Demand for better digital experience for citizens

## Imperatives

### Integration:
Integration of built and acquired operations – systems, sites, people and Assets

### Efficiency:
Improve operational efficiency while acquiring, building, and expanding assets and operations (including people, reducing OpEx and Energy cost).

### Higher Citizen Experience:
Deliver on faster and efficient citizen services with citizen engagement

### Most Livable City Index:
Sustainable and efficient city ecosystem resulting in best livable conditions.

Market size estimated to grow from USD 312.03 Billion in 2015 to USD 757.74 Billion by 2020, CAGR by 19.4%
Industrial Operations Transformation

IoT Edge to Enterprise Visibility (OMI)

Scope & Complexity

+ I/O Points
+ Users
+ Integrated Systems
+ Interconnections
+ Technologies
+ Cyber Threat Landscape
Our Strength: Installed Base, Global Reach, Partner Network
across six continents, over 40 countries

Industrial engineering & automation experience -
A solid foundation for Infrastructure Operations

1. Mission Critical Applications
2. Apt for Large/Global integration projects
3. Hardware Agnostic solution
4. Unique Deployment Approach

- 20 billion industrial parameters monitored
- 100,000 sites deployed
- 10 trillion industrial transactions processed
- 12,000 TB of information stored per year

- 4200 SI partners
- 5700 certified developers
- 160 technology partners
- 22 Project centers
- 10 R&D centers

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Data Centers: Manage growth

Single Pane: Uptime, Integration, and Efficiency

- Resiliency and High availability
- Standardization
- Remote Access
- System Integration
- Maximum Asset Utilization
- Situational Awareness
- Energy Optimization
Airports: Manage growth

Single Pane: Uptime, Integration, and Efficiency

- Operational Efficiency
- Disparate Systems
- Rapid Response Time
- Operator Training
- Security Regulations
- Dynamic Environment
- Passenger Experience
Facility/Fleet management

Energy Efficiency and Improved Operations

- Diverse Systems/Vendors
- Energy Optimization
- Rapid Response
- Contextual Awareness
- Operational Efficiency
- Single Pane of Visualization
Smart CITIES

**People**
- Enable operator for better serve business in a rapidly changing world
- Rapid turning your data into tangible value

**Technology**
- Facilitate cross agency decision making
- Optimize intra agency resources
- Gain control of data and transform operations

**Asset**
- Increase Asset Performance across asset lifecycle
- Automate asset management lifecycle
- Increase asset efficiency

**Studies**
- Power Grid/Electric Distribution
- Fire & Safety
- Education
- Environment
- STP
- Citizen Services
- ERP Integration
- Surveillance
- Asset Management
- Smart Traffic
- Smart Health
- Water Distribution/WTP
- Smart Buildings
- Smart Traffic

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We at AVEVA call this Transformative Integration Approach

System of Systems:

- Right Platform
- Right applications
- Right approach
Solution Approach: System of systems

CONNECT, COLLECT, INTEGRATE, ANALYZE, and ACT from disparate data sources

- Enterprise and Business Systems
  - SAP-Oracle-Microsoft and others

- Custom Solutions
  - Open extensions to other solutions
- Extensibility Tools
- Devices & Software

- System Platform
  - DI Objects
  - DA Servers
  - I/O Servers
  - OPC Servers

- OPC
- SQL
- XML
- OLE DB/ADO
- Proxy Objects

- Systems and Software
  - HMI Systems
  - DCS
  - Historians
  - LIMS

- Field Devices

Regional View

Site 1
- Assets
- IT systems

Site-n
What is system platform

System Platform: Transformational Platform for Operations

### Standardization at the CORE

**Engineering**
- Asset model based templates
- System Deployment
- Corporate standards
- Data driven generation

**HMI to Enterprise SCADA**
- Scalable and Hardware agnostic
- Functionality: Visualization, Application server, Connectivity, Historian, Workflow, Playback, Engineering studio, Asset/object based development, alarming, Extensibility, scripting and more.

**Operations**
- Failover
- Flexible Network architecture
- Lifecycle IT compliance
- **Suitable for System of systems**
- Extensibility
- Application integration
- Middleware for Operations
- Solution templates

**Suitable for System of Systems**

- ANY PROTOCOL
- ANY SENSOR, IOT, PLC, DCS or RTU

**Enterprise**

- SAP
- Oracle
- Infor
- Microsoft
- Epicor
- Etc.

**System Platform**

- Create models for enterprise wide standards
- Identify events correlations via context
- Mine for Historical Insights
- Monitor KPI performance

**I/O**

- AVEVA
Typical solution map

Command and control center: Digitizing the operational and users experience

Operation Challenges
- How can I monitor and control operations better?
- How can I provide safety and meet regulatory norms?
- How can I improve operational efficiency?
- How do I ensure availability and reliability of assets?

Information
- How can I enable better decision making?
- How can I provide a better User Experience to end users?

Includes next generation capabilities: Enterprise level integration, HTML 5 support, workflow and designed for IT/OT convergence, and data driven display generation with plug-and-play applications.
Integrated Command & Control Center

**Workflow/SOPs**
- Create complex workflows easily
- Connect people, process & IT/OT systems
- Send tasks on mobile & change process set points

**COP**
- Capture events/incidents across all integrated city operations

**Situational Awareness**
- Watch & monitor location, data and assets to access the criticality of events/incidents through a command center
- Automate field operations and access workflow/SOP steps
- Provide feedback to ICCC & achieve incidence lifecycle

**Field Operation Control**
- Smart Street Light
- Wifi & Smart Poles
- Parking
- ATCS
- ANPR
- RLVD

**KPI/Dashboard**
- Define KPIs for each integrated track or operation
- Provide reports, KPIs, historical analysis etc.

**Machine Control**
- Takeover the control of integrated subsystems
- Ability to change the set points

**IT/OT System**
- Utility Ops
  - Water SCADA
  - Energy SCADA
  - Sewage SCADA
- Environment
  - Environment Sensor
  - Solid Waste Management
- Buildings
  - Building Management System
- Safety
  - Video Surveillance
  - Emergency Response Button
- City infrastructure
  - Smart Street Light
  - Wifi & Smart Poles
  - Parking
- Traffic
  - ATCS
  - ANPR
  - RLVD
- City Services
  - Smart Health care
  - Smart Education
  - Community services
- Govt. Services
  - e-Governance

**Big Data - Historian**
- High performance storage
- Zero compression loss of process and event data
Four Unique Software application Lifecycle Segments

Leveraging differentiation at every step

- Ease of System Integration
- Iterative/Agile Build, Test and Deployment
- Operations efficiency, engineering efficiency and IT efficiency
- Template based approach
Differentiation!
Four Unique Software application Lifecycle Segments

**Strategy to reduce TCO at every step**

- **Build phase: Target Engineering efficiency:** Expand with Industrial Software Platform and command & control centers applications
- **Test and Deploy efficiently:** Develop applications to improve productivity and enable faster deployment by mobile/cloud
- **Operate:** Target Operations efficiency
- **Maintain solution:** Target IT efficiency and maintain template based solutions

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- Asset modeling
- Hardware abstraction
- Template development
- Template locking
- Navigation, Screen development
- Template base testing
- Flexible template based deployment
- Leveraging central team for development and remote team for local testing
- Flexible network architecture
- Situation awareness based visualization
- Support different form factors
- Alarm management
- Reliability and mission critical operations
- Customer FIRST maintenance program
- Solution support
Deployment: Iterative and Template based Approach

- Everything exists as an object template with resources, visualization / HMI, interfaces, workflow, etc.
- Master template based solution roll out with iterative processes
- Glocal model: Global expertise with local project teams.
- Structured project management processes and Enterprise Quality management structure
New Frontier: The Digital Journey Starts with the Digital Twin

Improve Operator Training, Reliability of Assets and Operational Profitability
### Efficiency Improvement and ROI Opportunities

#### Real-time Optimization # of FTE
- Maintenance workload assessment
- Asset management, spare parts, staff
- Budget planning
- Avg. $.5-1M annual benefit

#### Energy Saving
- Integrated with real-time calendars, events and scheduler for un-utilized areas/equipment
- Avg. 10% M annual benefit

#### Asset Utilization
- Real-time monitoring and control
- Network failure detection to minimize operations
- Avg. $250K reduction in operational costs

#### Predictive Diagnostics for rotating equipment
- Predictive failure warning and fault diagnostics
- Centralized asset performance monitoring
- Predictive models, condition profiles
- Avg. $100K savings for each predicted failure

#### Customer Satisfaction improvement
- Enhance reporting and feedback

#### Operator Training improvement
- Enhance operational efficiency of new workforce
- Avg. ROI within 12-18 months

### Intelligent Integrated Software Solutions for Infrastructure Projects:
A transformative integration approach (sites, people, process, assets and technology) to drive operational excellence across multiple sites through innovative solutions

### Operational Efficiency
- Energy
- Asset Utilization
- People Utilization
Success stories

AENA – Spain airports
Barcelona alone - 1M+ I/O
Transportation/Air

London Underground
System Platform, large Galaxy
Transportation/Rail

Edmonton International Airport
200,000 I/O
Transportation/Air

China Rail
1+ Million I/O
Transportation/Rail
Successes...

Railways

- Ebbsfleet International Station
- Stratford Station
- Kings Cross Station

Fleet Management

- Fletcher Allen Health Care (Vermont)
- University of Cincinnati, OH
- Venetian Hotel, Las Vegas
- NY School District, 1200+ buildings

Airports
Human powered to Empowered humans

Digital Services Platform: Fully integrated and immersive Process & Operations Experience

- Reduce total cost of ownership
- Improved Control room operations
- Efficiency Productivity
- Enhanced compliance