



Digitalization Practices to Improve the Delivery of Semiconductor Facilities

Making Project Delivery Smart

High-Tech Facility International Forum,
Taiwan, September 19, 2019



Exyte at a Glance

Focused Strategy on High-Tech Facilities



History of **100+** years



Special expertise in **controlled and regulated environments**



Serving the most **technically demanding clients**



Full spectrum of services from consulting and design to managing turnkey solutions



Client-centric operation in **20+** countries



Uniquely positioned to support clients **locally and globally**



Sales of **\$3.85bn** (2018)



Around **5,600** employees (2018) - highly experienced and motivated



Exyte is a global leader in the design, engineering and construction of high-tech facilities, plants and factories



Advanced Technology Facilities (ATF)

- Semiconductor
- Flat Panel Display
- Photovoltaics
- Batteries



Life Sciences & Chemicals (LSC)

- Pharmaceuticals & Biotechnology
- Food & Nutrition
- Consumer Care
- Specialty Chemicals



Data Center (DTC)

- Cloud Computing
- Co-Location
- High Performance Computing
- Enterprise

Agenda



1 Delivering Clients' Expectations

2 Core Concept: Integrated Cloud Platform

3 Exyte's Digitalization Practices

4 Smart Project Delivery with Digitalization

Digitalization: Key Driver for Exyte's Value Proposition



Enabling fast and consistent fab project delivery

Clients' expectations

- Status update on demand
- No surprises
- Fast schedule
- Rapid reaction to changes
- Optimizing Capex
- Fast transition to operations

Without higher costs due to digital tools

Exyte delivering and exceeding clients' expectations

Real Time Transparency

Digital dashboards: **Real time project reports** – cost, schedule and quality

Consistent Processes

Delivering the **same client experience, every time**

Speed & Flexibility

Deliver projects faster and reduce turnaround time of change orders

Agenda



1 Delivering on Client's Expectations

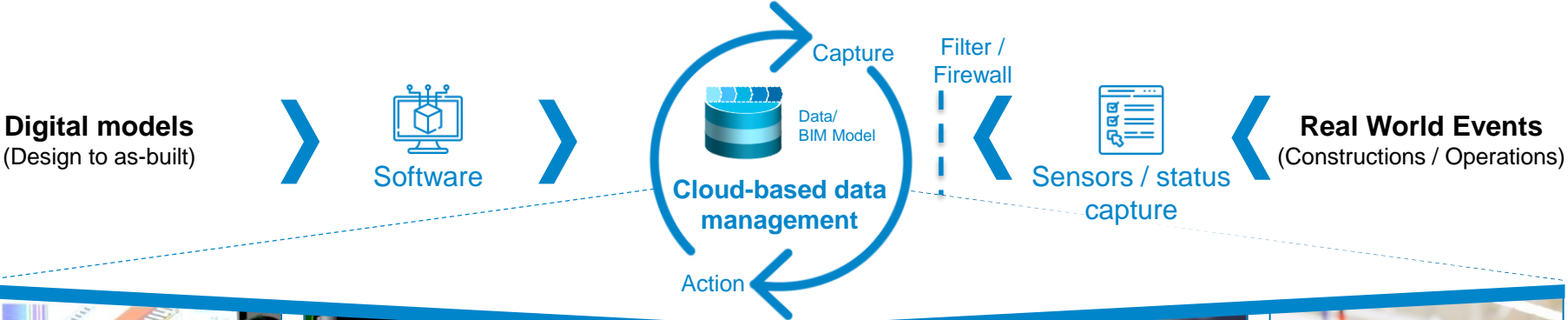
2 Core Concept: Integrated Cloud Platform

3 EXYTE's Digitalization Practices

4 Lessons Learned & Way Forward

At the Core: The Intelligent BIM Model

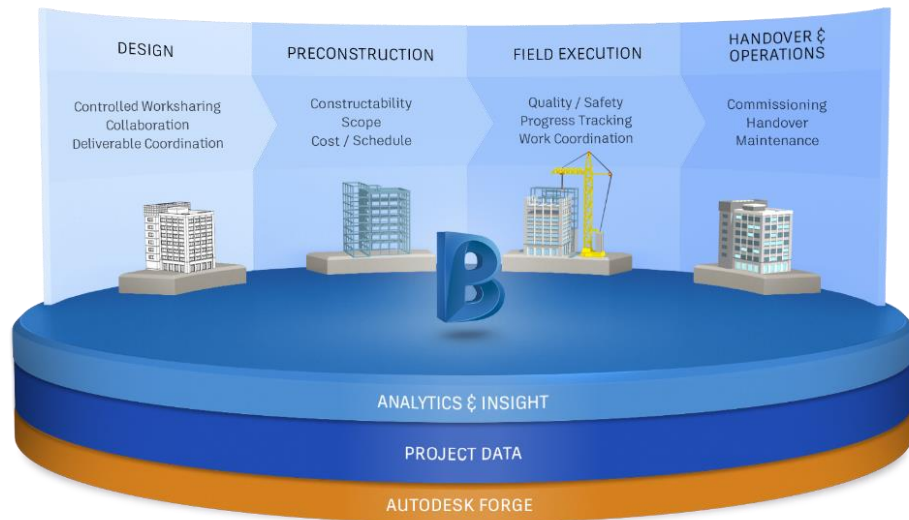
Growing virtually and constantly aligned to reality



	5D BIM model			As-built model	As-used model
Concept	Design	Pre-Construction	Construction	Operations	

Exyte is Using a Digital Design & Construction Platform

Collaborating across the Cloud



Using the power of a digital platform for project delivery



Cloud-based platform hosting Exyte's BIM models for **seamless collaboration** across project phases and disciplines



Based on **Autodesk's BIM360**



Hosting Exyte's BIM models, connecting them to relevant systems and processes



Implement **digital workflows** – also integrating external partners



Create transparency of processes to improve operational efficiency and quality of deliverables

Benefits

- Same up to date models and data available to all involved parties
- 70% time saved searching and gathering documents
- 50% less time to clarify and solve issues on site
- 100% transparency on issues, workflows and deliverables

Agenda



1 Delivering on Client's Expectations

2 Core Concept: Integrated Cloud Platform

3 EXYTE's Digitalization Practices

4 Digitalization at Exyte – Our Way Forward

Standard BIM Objects for Fast Delivery of Concept

Incorporating 4D and 5D BIM (Cost and Schedule Data)



Client

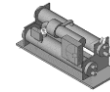


Specification &
draft models



Integrated cloud platform

Cost Data & connected Systems
Scheduling Data & connected Systems
BIM Model (incl. technical Specification)



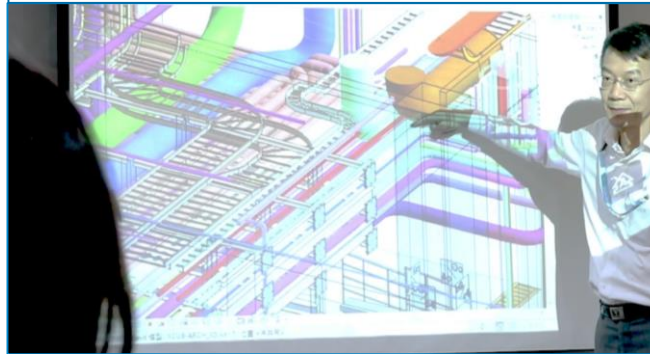
Objects



BIM Libraries

Benefits

- Creating concept “simply” by connecting objects from the BIM library into a model
- Concept with 3D model, costs and schedule – Within days



Draft schedule &
timeline **(4D BIM)**



First cost estimation
(5D BIM)

Concept

Design

Pre-Construction

Construction

Operations

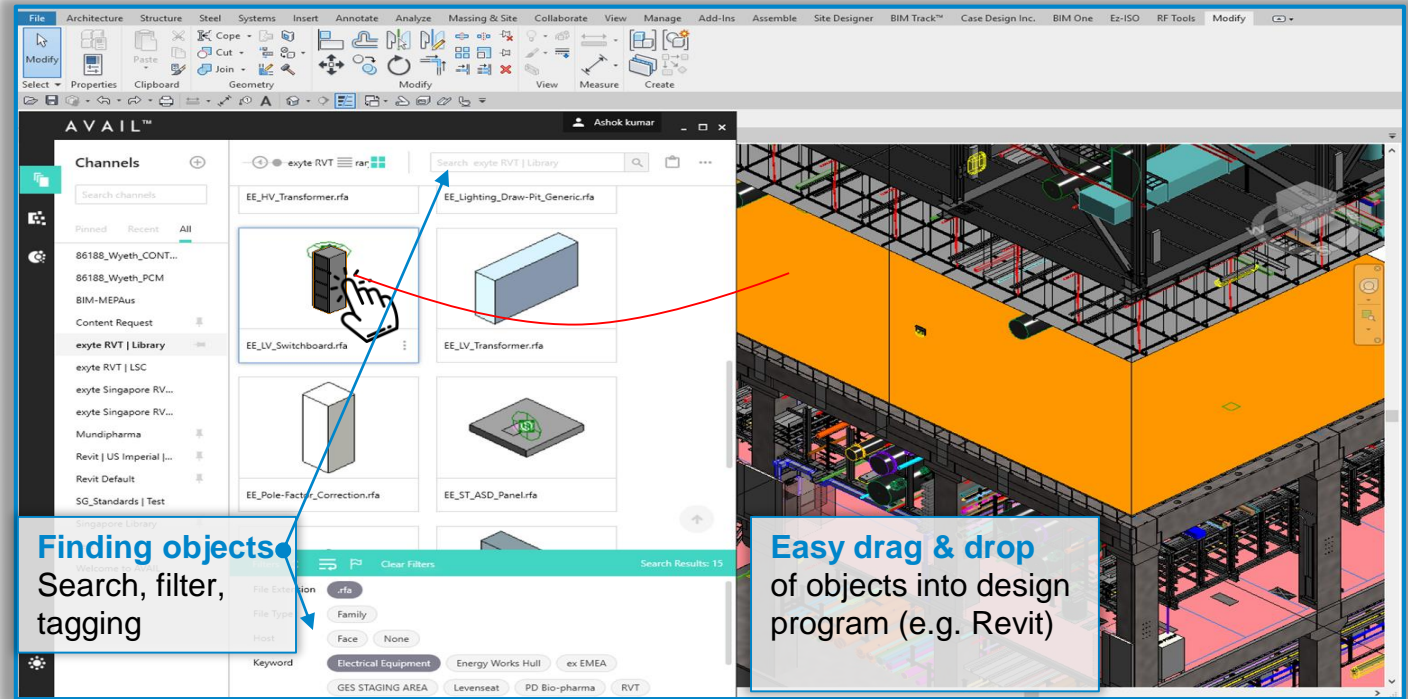
Using the BIM Library from Concept to Detailed Design

Easily Drag and Drop Objects to Revit



Benefits:

- Case study (50k m² project, 1.500 objects):
- 80% time reduction finding & integrating objects into model
- Overall schedule reduction achieved
- Higher data quality leads to
- Continued use of data along project life-cycle
- More reliable procurement & construction processes



Concept

Design

Pre-Construction

Construction

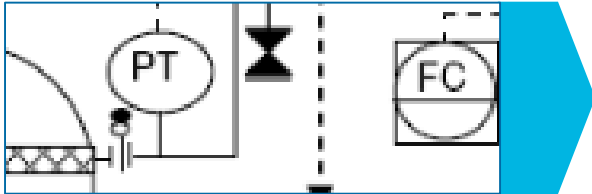
Operations

Detailed Design based on Smart Schematics

Resultant BIM Model Generates Bill of Materials for Estimating and Procurement

Smart P&IDs

(Connected Process & Installation Diagram)



Process & electrical systems are based on smart schematics – linking technical data to the 3D model

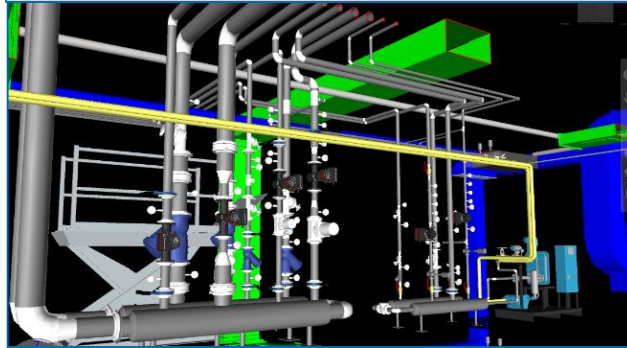
Benefits using smart P&IDs

- Linking P&IDs to 3D model improves model quality
- P&ID created in 10-20% less time
- Up to 50% less time to check & rework P&ID's / 3D Model



Integrated cloud platform

- Cost Data & connected Systems
- Scheduling Data & connected Systems
- BIM Model (incl. technical Specification)



Design is completely performed in BIM

Example	Item 1	Item 2
Quantity	5	350
Cost	\$	\$\$

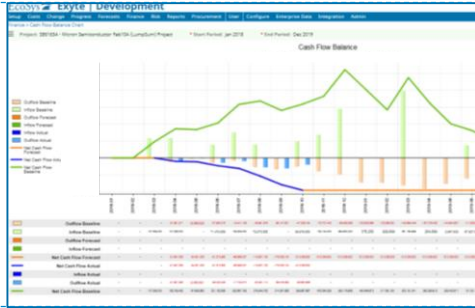


Procurement driven by BIM

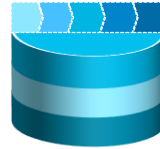
- Automatic alerts when a design change occurs
- Provides easy identification of long lead-times

Connecting Scheduling and Planning

Detailed Schedule (4D) and Costs (5D) Connected to the BIM Model



\$
Cost & schedule data



Integrated Cloud Platform



Bill of Quantities

Changes to the model trigger real-time updates

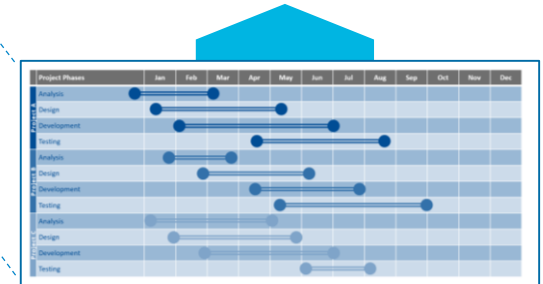


Subcontractors

System-based project controls

Visualize the sequence by connecting it to the BIM Model (4D)

- Transparency and verification of construction schedule
- Reduction of conflicts in schedule & optimization of critical path
- Visualization for better understanding and alignment with all partners



4D: Synchronized with detailed schedule (Primavera P6)

Concept

Design

Pre-Construction

Construction

Operations

Using System-based Project Controls

Creating real-time transparency and enhancing forecasting reliability

Benefits

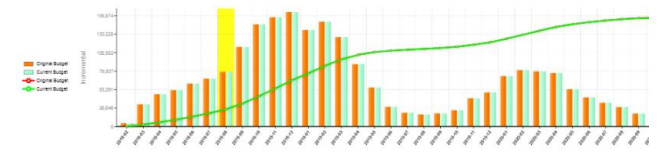
- Faster project setup (~10%)
- Faster resolution of issues (up to 20%)
- Faster change order turnaround (15 - 20%)

Sample dashboards for:

Cash-flow management, incl. forecast



Budget development – planned vs. current



Dynamic risk register



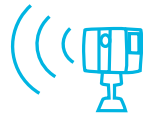
Digitizing Construction & Supply Chain Management

Data-driven support from the BIM Model



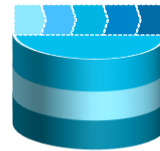
Material tagging

for optimized management
(on and off site)



3D Scanning

for progress reporting
and QC/QA



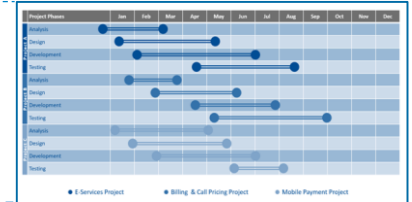
Integrated Cloud
platform



People tagging

Tracking of presence and
counting of disciplines/trades
(safety & planning)

Update of schedule
– Synchronized
across supply chain



**Automatic commercial
processing**
(Invoicing, contract
management, etc.)



As-built model
is created step by step



Concept

Design

Pre-Construction

Construction

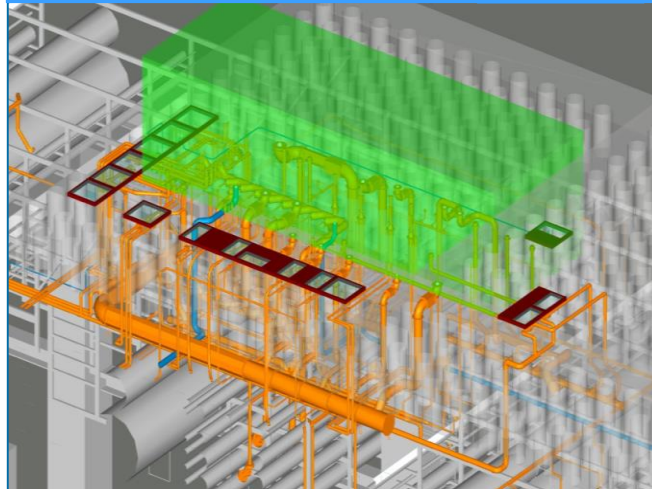
Operations

A Fab's Digital Twin Reduces Costs

Using the Integrated Cloud Platform for Operations

The 5D-Plus Digital Twin

Source: Exyte Group, 2019



5D-Plus: Integrated model for operations

- Represents the as-built status of Basebuild and Tool Install
- Includes schedule, cost, specification data & construction history

The addition of IoT/Industry 4.0 Technology provides

- Visibility of strategic fab KPIs
- Performance analysis & benchmarking
- Remote access, virtual tours
- Training on real-time data
- Fab-wide environmental modelling
- Data availability for planning of upgrades or new fabs

Resulting in reduction of OPEX and future CAPEX costs

Concept

Design

Pre-Construction

Construction

Operations

Exyte is using digitalization to generate significant improvements:

Driving a paradigm shift in performance, cost, quality and transparency – from concept to operations

Digitize



Digitalize & integrate
tools, processes and
workflows

Automate



Automate
connected processes

Go smart



Analyze & Predict:
Artificial intelligence to
optimize project delivery

Cloud-based BIM models and data