Factory[5]

F5 Platform

Work with your data in single ecosystem

F5 **Platform**

F5 Platform is a big data analytics platform for industrial enterprises. It increases business efficiency through advanced analytics and data management

Key users

- CIO departments
- CDO departments
- Developers and integrators of analytical solutions

Features

- Develop analytical products for specific business needs
- Estimate quality and suitability of incoming data
- Bring together huge amount of data from multiple distributed sources

Customer segments

- capital-intensive medium-sized and large industrial enterprises

Typical problems

- Big amount of distributed data sources in variety of IT systems
- Lack of data quality control
- Independent local automation systems without centralized data management
- No ready-to-use tools and algorithms for big data analytics

F5 Platform
How it works

Connectors to data sources

Traditional DB
PostgresSQL, MS SQL, My SQL, Oracle

Non-relational DB and storages
ClickHouse, InfluxDB, HDFS, MongoDB

Cloud storages
Amazone S3, Azure CosmosDB, YandexDB

Connected devices, Historian
MQTT, CoAP, AMQP, OPC (UA)

File sources
CSV, XML, JSON

Data transport infrastructure

Kafka + Spark Streaming

Batch and stream processing

Data preprocessing tools

Expert rules service

MX-editor

Math service

Pipeline editor

Product distribution

Analytical product
API Gateway

Report

Business application

Visualization panel
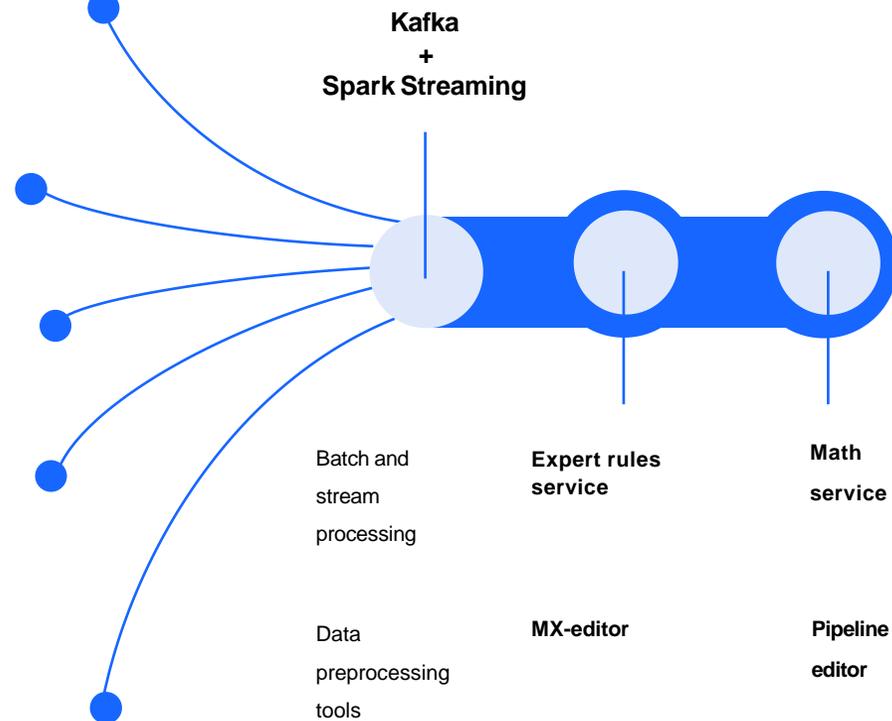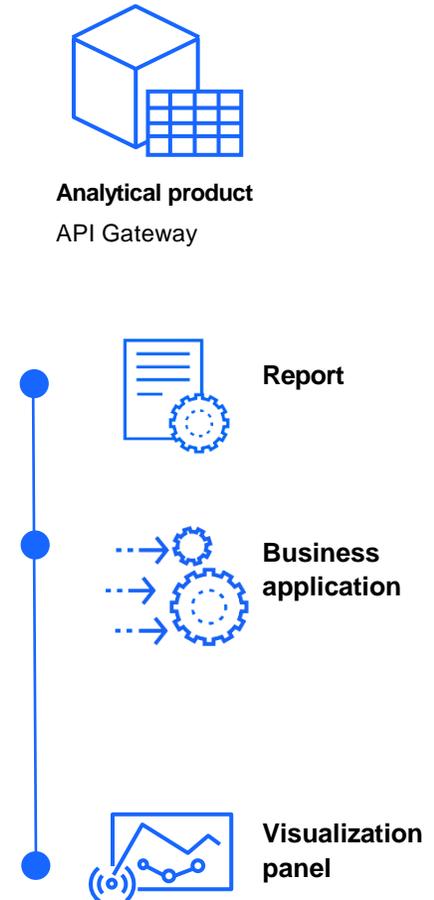
Customer IT environment

1C

SAP

MS

3

F5 Platform

Ready-to-use toolbox for fast business-application development
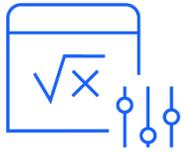
Model development and runtime environment, data storage and integration bus which do not require installation of any additional services
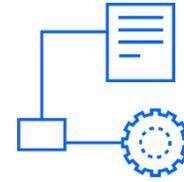
Simultaneous execution of 5000+ algorithms and 50,000+ expert rules
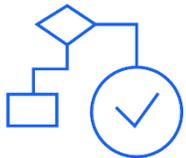
Built-in libraries for data labeling

Algorithm development and debugging environments built into the runtime environment
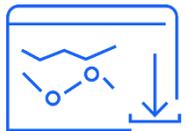
Over 10Gb per second processing of unlimited data streams

Fast development of expert rules thanks to proprietary DSL language which doesn't require IT skills

Data storage

- Online data download from integrated systems

- Data extraction from text files

- Manual data entry

- Calculation performance monitoring

- Storage of both downloaded and calculated data

- Data download process monitoring

F5 Platform
Data classification

F5

MX-editor

Includes traditional mathematical model development tools like Jupyter notebook, TensorFlow and Pandas libraries. MX editor automates analyst's and data scientist's routine work.

Expert rules library

Detects incidents in data streams and packets. Rule engine is based on Scala language and effectively analyzes time series.

Factory⁵

John Smith
CDO

LIBRARY

DMC MORI DMC 365V ecoline
Models: 6   The rules: 2

DMC MORI CTX310 ecoline
Models: 3   The rules: 5

Data anonymization
Models: 2   The rules: 2

Data profiling
Models: 27   The rules: 14
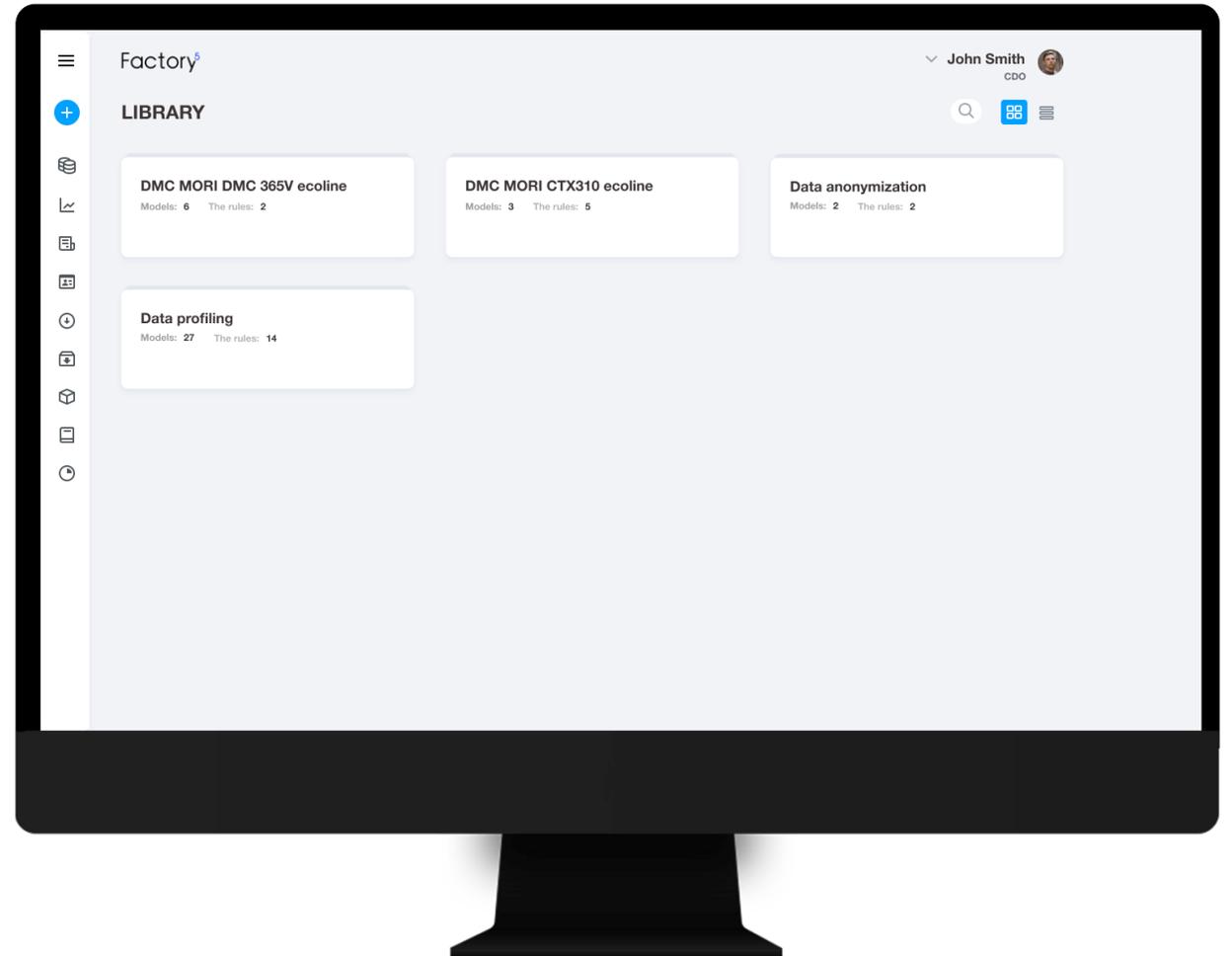
F5 Platform
Data classification

- **Industry-specific library of models and rules**

- **Adding new models and rules**

- **View rule or model:**
  - Object, process or variable
  - Fork tree in repository.

- **View, filter and sort the library**

- **Search models and rules by:**
  - Application;
  - Industry;
  - Object or process;
  - Variable

- **Fork rules and models in editor**
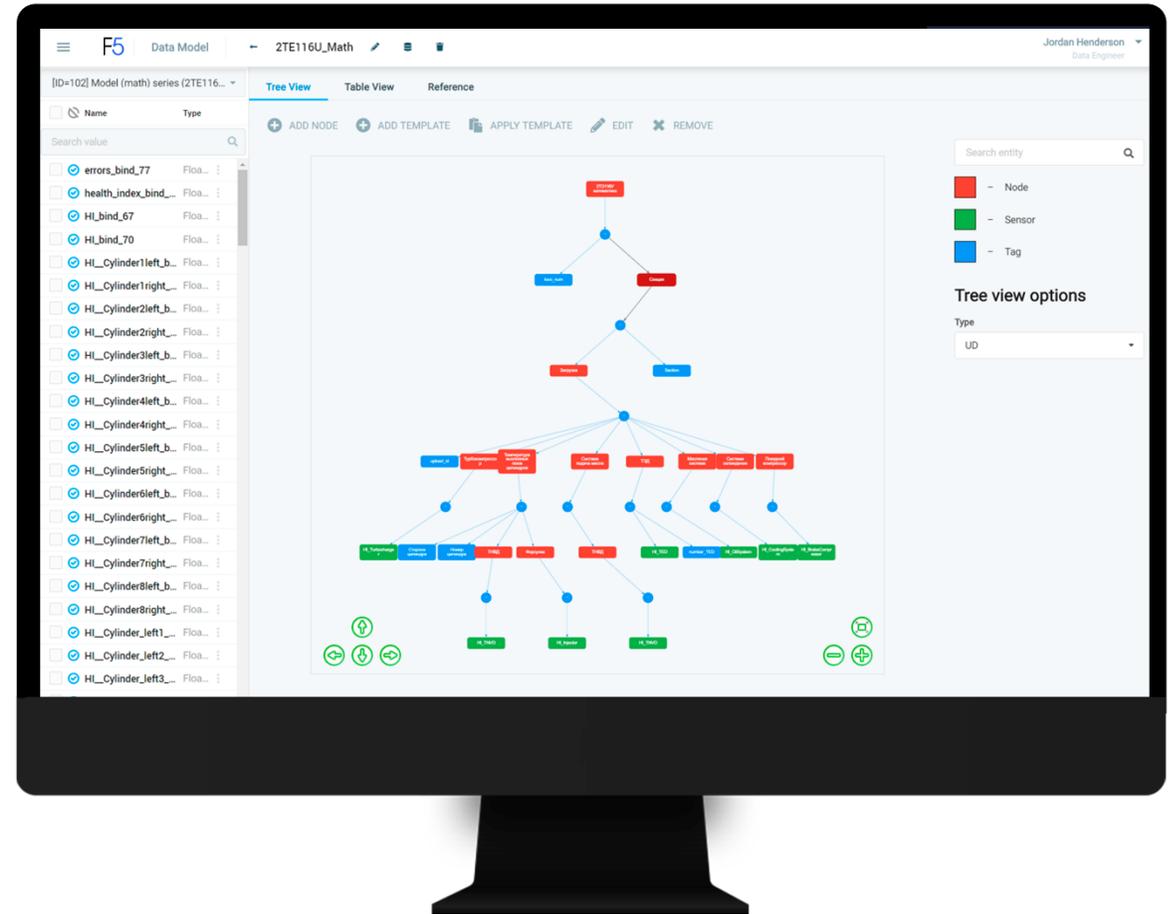
MX-model development process

MX-models are predictive models designed for identifying pre-failure states and predicting breakdowns of technological equipment. They use both telemetry data from sensors, and calculation methods for building an engineering model.

1. Analysis	2. Engineering model	3. Node model

1. Telemetry data

$$U = A * I + B * w * F(I)$$

where:

U – traction motor voltage;

I – traction motor armature current;

w – wheelset rotation speed

F(I) – magnetic flux saturation function
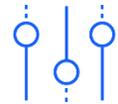
A, B – coefficients calculated from data

2. Engineering data

(process physics)

Input parameters:
SM1 - KM in «Recuperation» (inSM1_R),
KT4 – (inKT4),
Current threshold exceeded (SI_Imax),
Wheelset speeds (V1,V2,V3,V4),
Currents (I1,I2,I3,I4),
Voltages (Ud1, Ud2, Ud3, Ud4)
"OP1 - K11, K12" (outStup1)
…
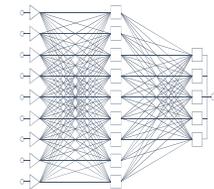
Traction motor voltage

– Actual voltage
Calculated voltage
= Anomaly

8

MX-model development process

MX-models are predictive models designed for identifying pre-failure states and predicting breakdowns of technological equipment. They use both telemetry data from sensors, and calculation methods for building an engineering model.

4. Anomaly detection	5. Identification of degradation trends	6. Health index calculation
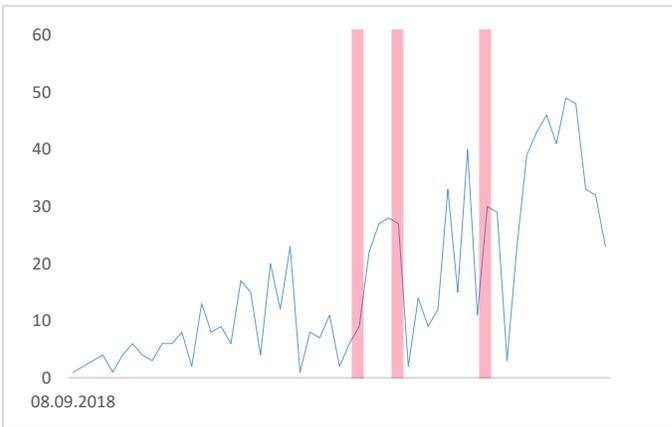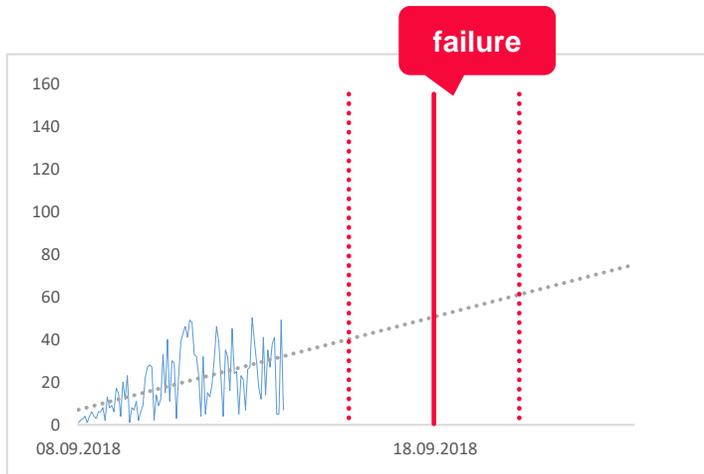
Expert rules

Expert rules are based on proprietary DSL language tailored for time series data

```
SELECT
{select_fields},{Speed},{OilPump},grow,change,claster,growSpeed,claster_rule,
  MIN(claster_rule) OVER (ORDER BY {datetime} ROWS BETWEEN
CURRENT ROW AND UNBOUNDED FOLLOWING) AS {rule_field}
FROM (
SELECT *,
  MAX(Speed_) OVER (PARTITION BY claster_rule) AS maxSpeed,
  MIN(Speed_) OVER (PARTITION BY claster_rule) AS minSpeed,
  COUNT(claster_rule) OVER (PARTITION BY claster_rule) AS
count_claster_rule,
FROM (
SELECT *,
  CASE
    WHEN Speed_<=260.0 AND growSpeed=-1.0 THEN claster
    ELSE NULL
  END
    claster_rule
FROM (
SELECT *,
  MAX(grow) OVER (PARTITION BY claster) AS growSpeed
FROM (
SELECT *,
  MAX(change) OVER (ORDER BY {datetime} ROWS BETWEEN
UNBOUNDED PRECEDING AND CURRENT ROW) AS claster
FROM (
...
```

```
...
SELECT *,
  CASE
    WHEN ((Speed_>lagSpeed)AND(Speed_>=leadSpeed)) OR
((lagSpeed<Speed_)AND(lagSpeed<=lag2Speed)) THEN CAST(id AS
FLOAT)
    ELSE 0.0
  END
    change,
  CASE
    WHEN((Speed_>lagSpeed)AND(Speed_>=leadSpeed)) THEN -
1.0
    WHEN ((lagSpeed<Speed_)AND(lagSpeed<=lag2Speed)) THEN
1.0
    WHEN (id=0)AND (Speed_>=leadSpeed) THEN -1.0
    WHEN (id=0)AND (Speed_<leadSpeed) THEN 1.0
    ELSE NULL
END  grow
FROM (
SELECT *,
  CAST({Speed} AS FLOAT) AS Speed_,
  LAG(CAST({Speed} AS FLOAT)) OVER (ORDER BY {datetime}) AS lagSpeed,
  LEAD(CAST({Speed} AS FLOAT)) OVER (ORDER BY {datetime}) AS leadSpeed,
  FIRST_VALUE(CAST({Speed} AS FLOAT)) OVER w AS lag2Speed
FROM  {table}))))))
WINDOW  w AS (ORDER BY {datetime}
 ROWS BETWEEN 2 PRECEDING AND CURRENT ROW)
```

lag(Speed) != 0 and Speed = 0 andThen OilPump != 0 for 90 sec < 60 sec

Expert rule — set of conditions which lets the platform to detect preset sequences in a dataset. Rules help to recognize patterns and label the data for training sample.

Description using
Spark language

Description using
Factory5 DSL language

F5 Platform
Pipeline manager

F5

Optimize platform performance, debug rules engine and MX-models and create custom data processing scenarios with flexible pipeline manager
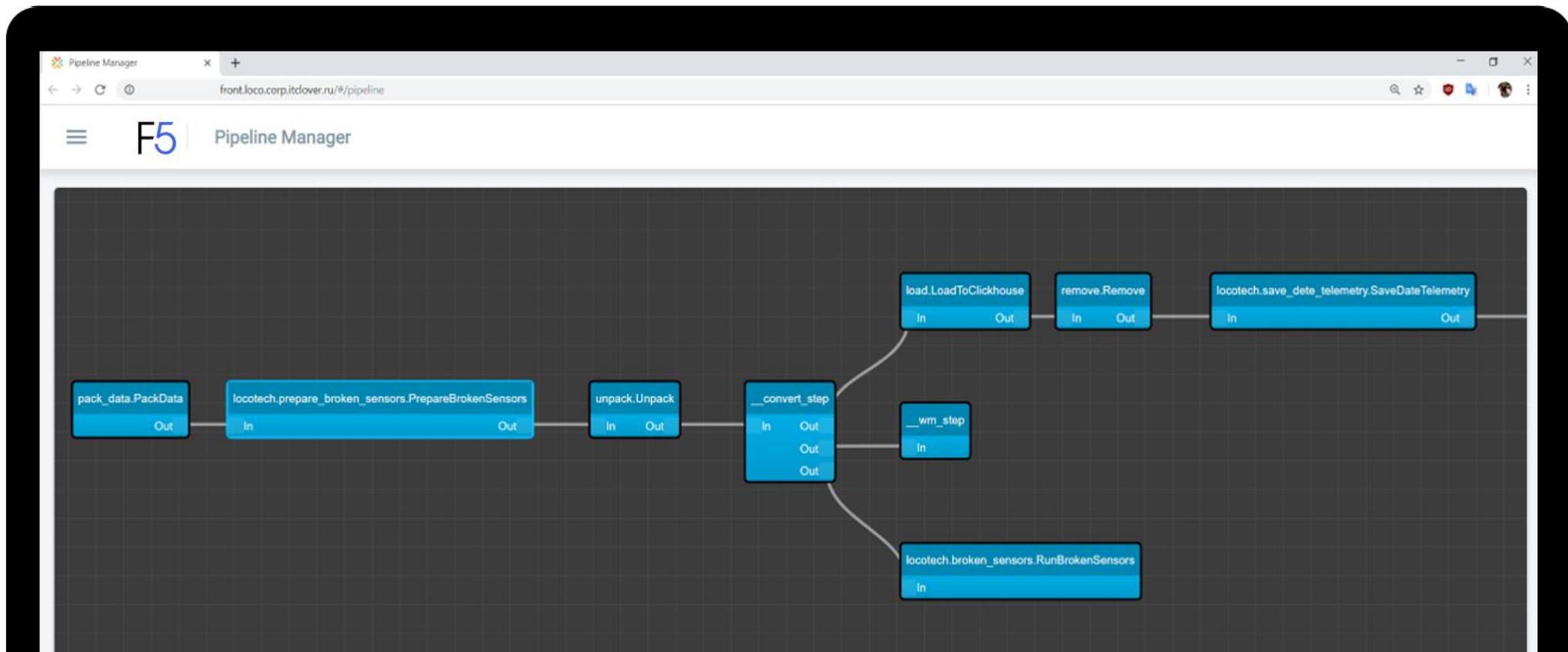
Platform development directions

Higher speed of
platform deployment

Compliance to the latest data security
requirements

More datatypes: photo, video, text,
transaction data

More tools for business-application
development

Transfer to PaaS
format

Wider range of platform
application examples

Factory⁵

AI – ecosystem
for business application
development

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