



Going Long: Enabling Expansion of TransCanada's Enterprise Analytics Program

Presented by

Joshua Linville & Keary Rogers



Agenda

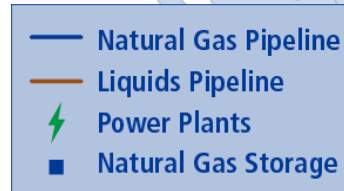
- ➔ **Company Information**
- ➔ **Business Challenges**
- ➔ **Technology Challenges**
- ➔ **Technical Solution Details**
- ➔ **Results**

One of the Largest Natural Gas Transmission Companies in the U.S.





- ~31,000 miles (50,000 km)
- Serves ~20% of U.S. demand

Connected to High-Demand Markets

- LDC demand
- Electric Power Generation
- Growing LNG Market

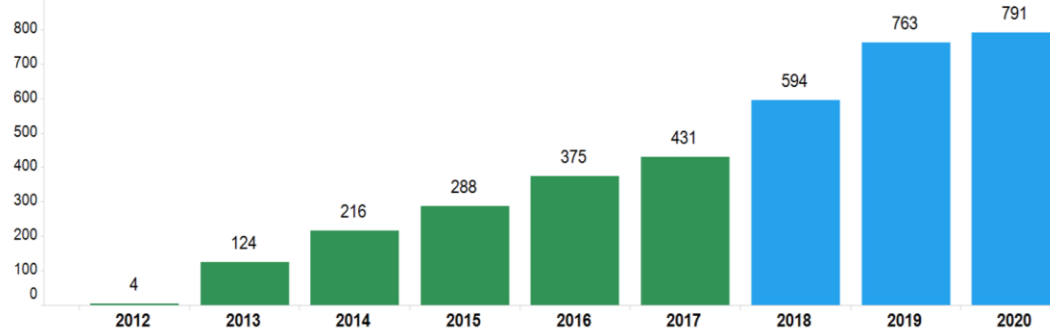


Business Challenges

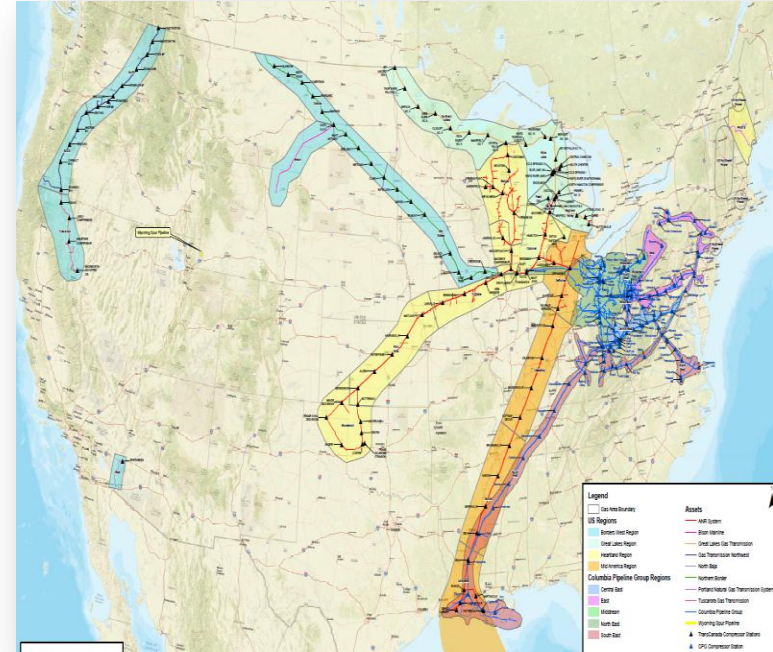
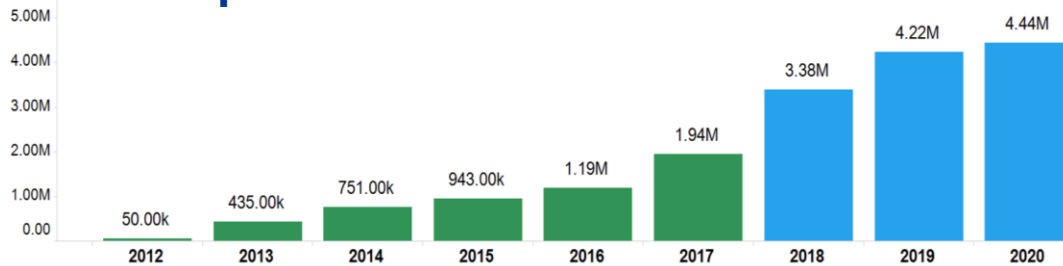
-  **Rapid Expansion of Compression Fleet**
-  **Compression Fleet Anomaly Detection**
-  **Compression Fleet Optimization & Management**
-  **Expand Beyond Compression: Storage, Environmental, Gas Quality, Measurement**

U.S. Gas Enterprise Analytics Implementation Plan

Units



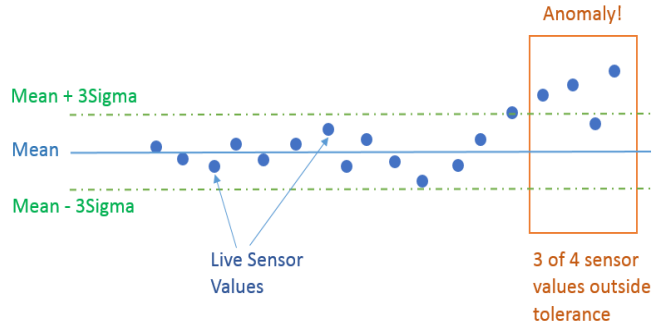
Horsepower



Enterprise Analytics – Anomaly Detection & Fleet Optimization

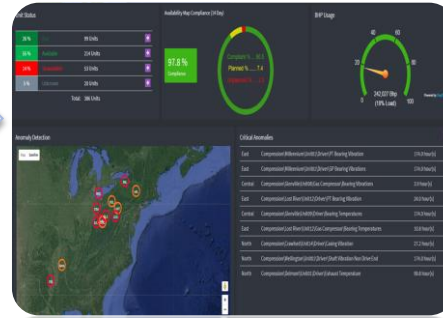
Advanced Algorithms

Over 16,000 Data Streams

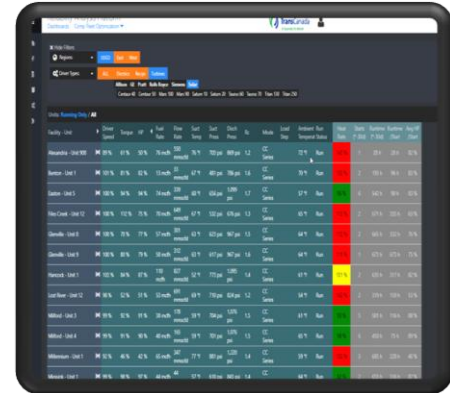


Executive Dashboard

Critical Anomalies



Fleet Optimization



EA Process

Alert, Investigate, Inform



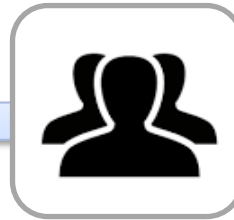
Sensor Data



Algorithms



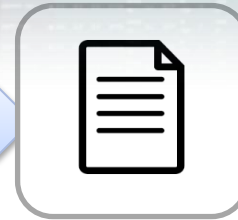
Dashboard &
Notification



Investigate

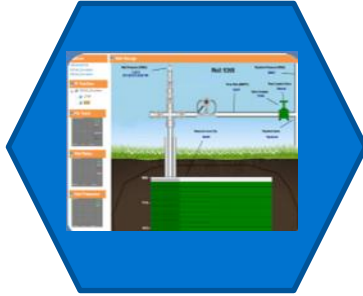


Take Action



Document

Beyond Compression....



Storage



Gas Quality

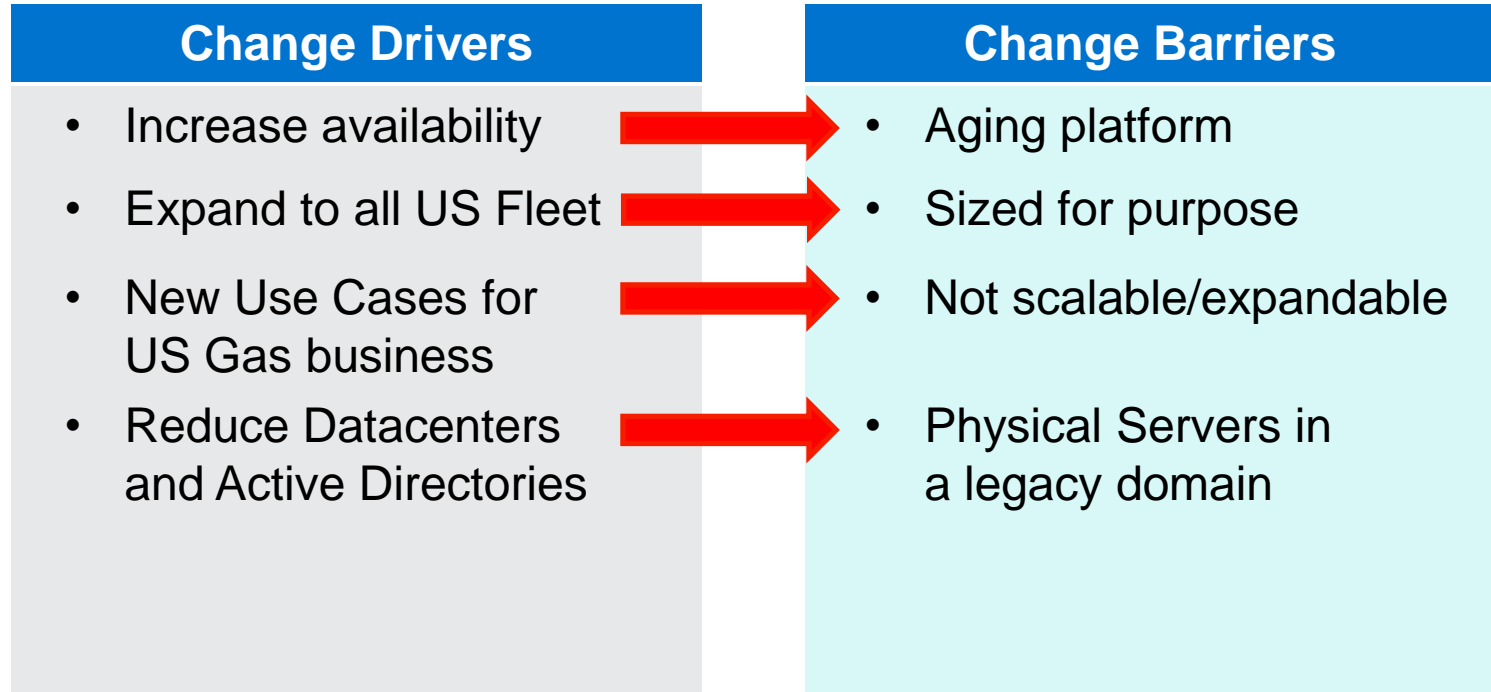


Environmental



Measurement

Change Was Needed! Drivers & Barriers



Technology Opportunities

Design Goals

- Scalable infrastructure
- No single points of failure
- Latest supported OS, DB, and OSIssoft applications
- Support multiple, custom application environments

Solutions

- Converged Architecture
- Site Diversity and Load Balancing
- AlwaysOn & Clustering
- PI Server 2016, PI AF 2017, PI Vision
- IIS Web Farms

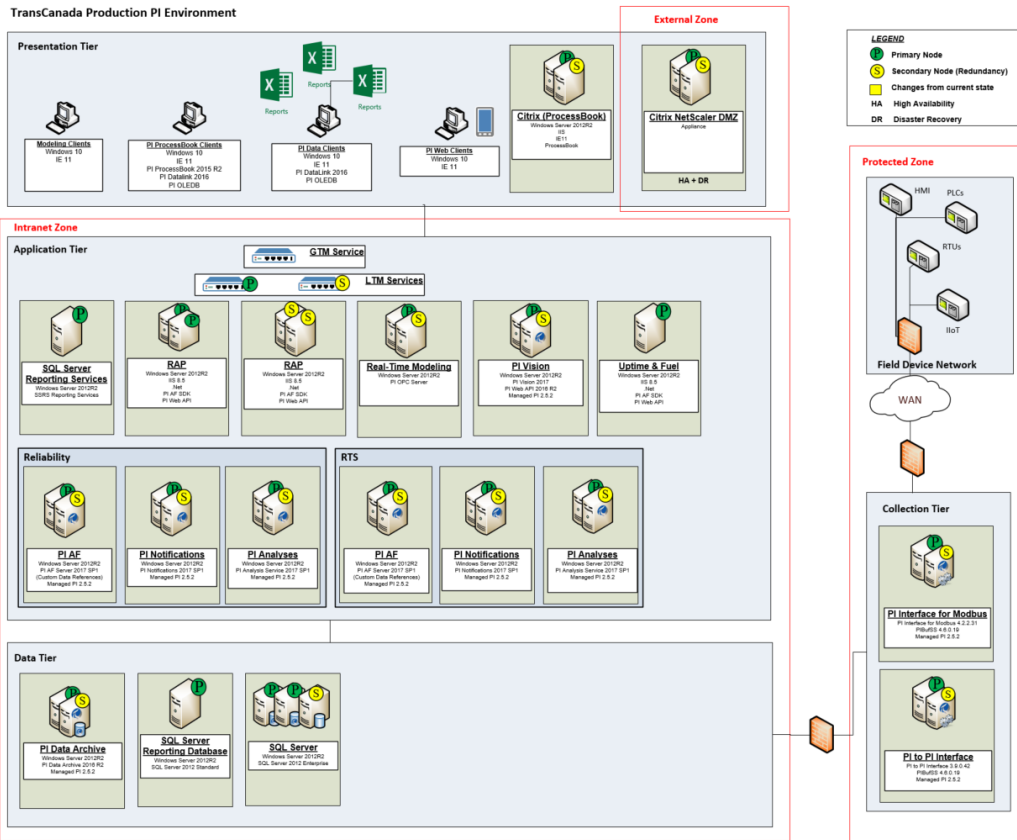


Microsoft®
SQL Server®
AlwaysOn



Logical Architecture – Overall

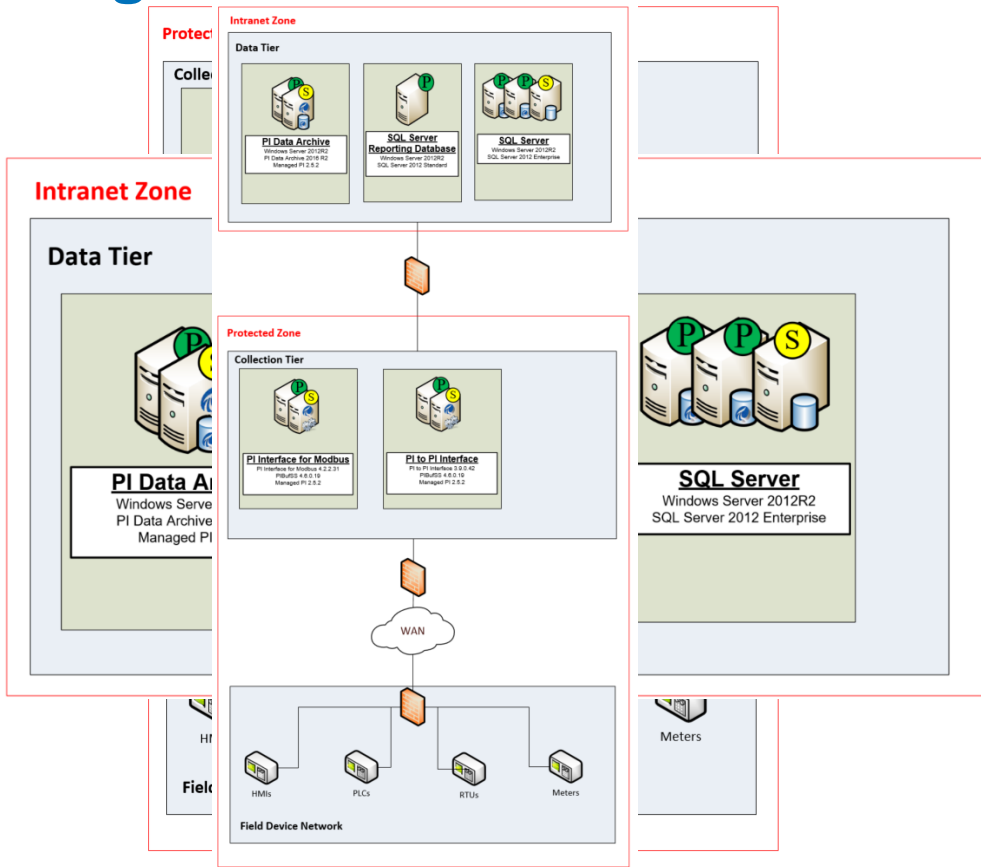
TransCanada Production PI Environment



Architecture

- Tiered Design
- Security Zoning
- Site Diversity
- Load Balancing
- ~80 servers across Prod, Test, Dev

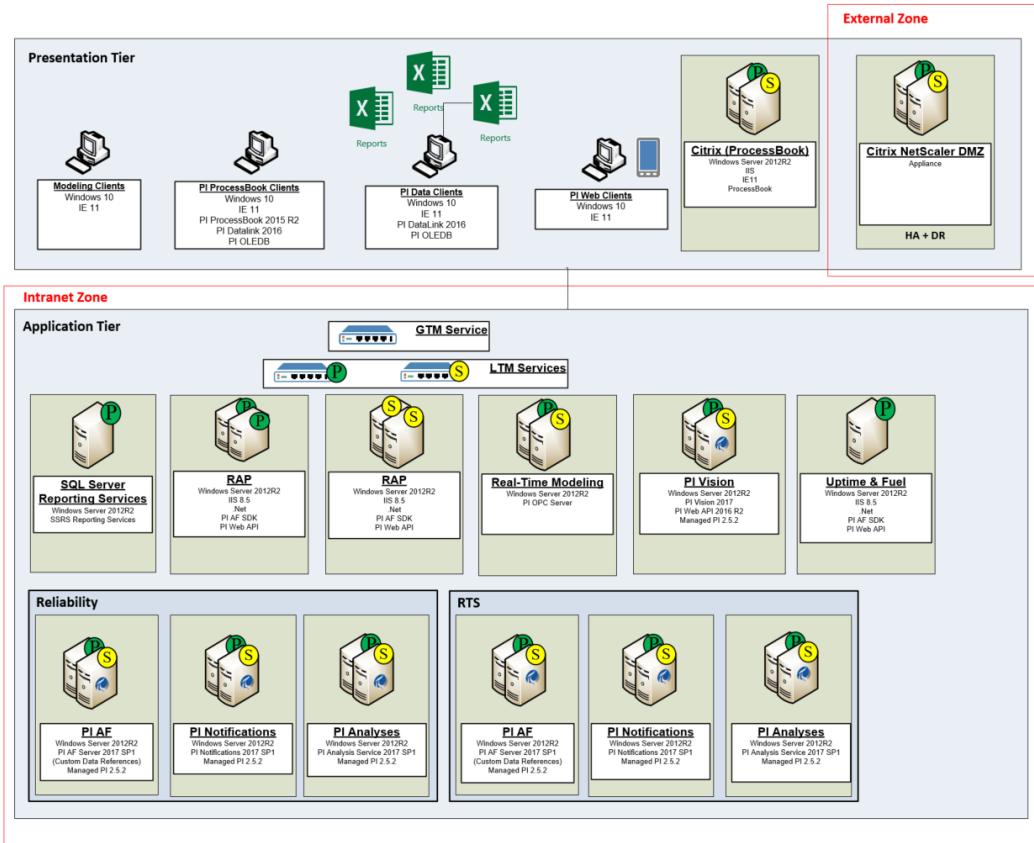
Logical Architecture – Collection/Data Tiers



Architecture

- Interface servers in Protected Zone
- Interface servers at both Primary and Secondary
- Interfaces are HA
- PI Collective across data centers
- SQL Server AlwaysOn in 2+1 Availability group

Logical Architecture – Application/Presentation Tier



Architecture

- IIS Web Farm hosting UX
- PI Vision using Load Balancing
- Modularized AF architecture
- AF, Analyses, Notifications are HA via WFC
- PI-dependent application hosting (modeling etc.)
- Various end-user tools

Summary

COMPANY and GOAL

"The term Enterprise Analytics refers to a program aimed at leveraging leading technology tools to analyze data to enable the execution of proactive actions intended to avoid a negative event entirely or minimize the impact of such an event."

Be Safe, Be Available, Be Optimized



CHALLENGE

- Rapid Expansion of Compression Fleet Anomaly Detection
- Compression Optimization & Management
- Expand Beyond Compression: Storage, Environmental, Gas Quality, Measurement

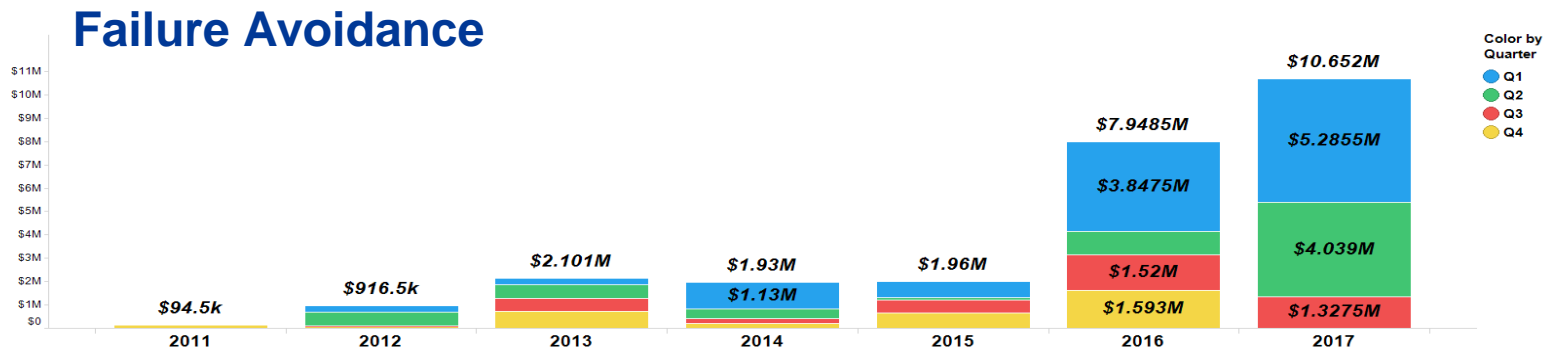
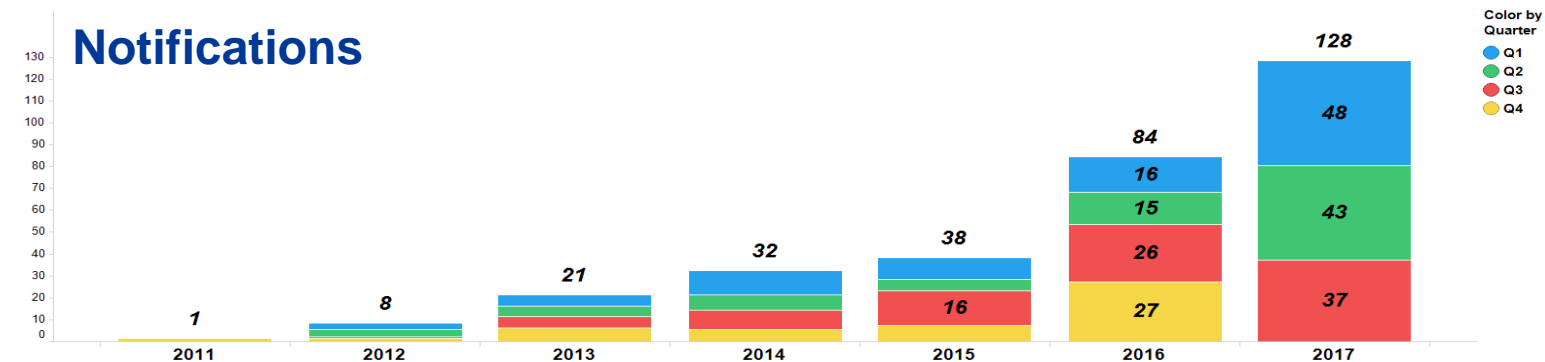
SOLUTION

- Scalable, Flexible Converged Infrastructure
- Geographic Diversity & Load Balancing
- Modularized AF Environments
- Custom application hosting via IIS Web Farms
- PI Vision

RESULTS

- 2017 Failure avoidance (Q3) costs of 10.6M on 2M BHP
- New Infrastructure positioned to support projected growth to 4.4M BHP
- HA, Diverse US Gas PI System infrastructure
- Beyond Compression Opportunities....

Anomaly Detection Results



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Questions

Please wait for the **microphone** before asking your questions

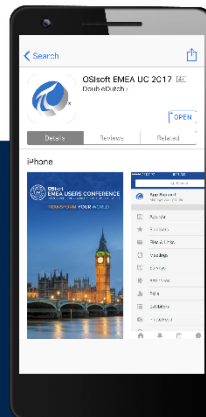


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감사합니다

Danke

谢谢

Merci

Gracias

Thank You

ありがとう

Спасибо

Obrigado