

ACGM
ANNUAL CONFERENCE
AND GENERAL MEETING



2014
CONNECTING A MOBILE WORLD

June 1-4
Victoria Conference Centre
720 Douglas St. Victoria,
British Columbia, Canada V8W 3M7

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City of Toronto – Intelligent Transportation Systems

**STAYING CONNECTED UNDER SEVERE
WEATHER CONDITIONS**

WARNING

The 'I' in ITS as referenced in this presentation actually stands for Innovation.

The concepts presented herein are simply ideas for your consideration. Do not attempt any of these concepts without first conducting a proper business case to determine whether the needs warrant the costs.

OUTLINE

- ✖ Background
- ✖ Traffic Signals
- ✖ CCTV Cameras
- ✖ Variable Message Signs
- ✖ Central Systems/Software
- ✖ Overall System Power/Communications
- ✖ Summary

SEVERE WEATHER BECOMING THE NORM?

- ✖ In recent years, the City of Toronto has been afflicted with a number of severe power outages due to weather and other causes:
 - + Severe flooding (July 2012)
 - + Severe flooding (July 2013)
 - + Ice storm (Dec. 2013)
- ✖ Need to keep the ITS alive!



Lake Shore Blvd. – July 2013

ITS AVAILABILITY

- What good is the ITS if it's not available when you need it?



NOTE: Fabricated scenario



COST IS A FACTOR

- ✖ Designing systems to ‘stay alive’ does have significant cost implications
 - + Capital and ongoing maintenance
- ✖ Can’t do it everywhere
- ✖ Select key corridors or critical traffic management systems
- ✖ Need to prioritize

THE SECRET – PART I: TECHNOLOGY



Solar power
trickle charges
my batteries



Utility power
trickle charges
my batteries

THE SECRET – PART II: OPERATIONS

- ✖ We need to revisit our operational strategies
- ✖ Which ITS must be operational in the event of a power outages?
 - + Do we need all traffic signals? ‘Operation’ vs ‘Flash’
 - + Do we need all cameras?
- ✖ Do we need to display safety messages when the power is out?

TRAFFIC SIGNALS - UPS

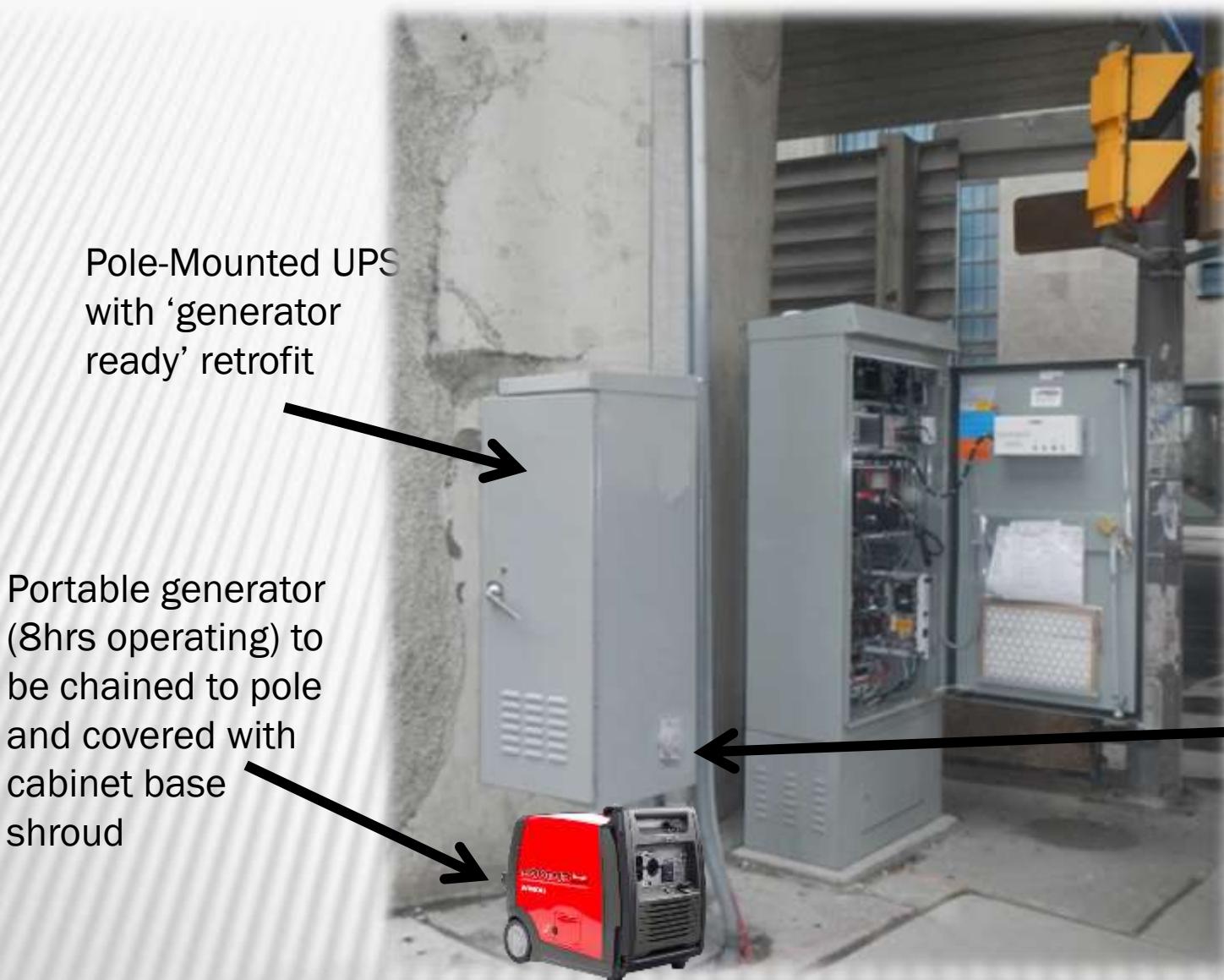
- ✖ If properly rated and specified against load could achieve **8hrs operation** or more, 10-20 hours on flash
- ✖ To extend battery life consider:
 - + Powering only the vitals
(eg. no heaters, fans)
 - + Operation during peak hours
 - + Flash during off-peak



Typical UPS enclosure

TRAFFIC SIGNALS – UPS + GENERATOR

- ✖ City came up with retrofitted, ‘Generator Ready’ UPS design specification
- ✖ In loss of utility power, signal automatically switches to UPS power, generator can then be used to charge batteries & run signal to extend operation life
 - + Experiment showed that we were able to double operating window up to ~20hrs in some cases!



Portable generator +
Generator ready
UPS enclosure

TRAFFIC SIGNALS - COMMUNICATIONS

- ✖ Consider redundant communications
- ✖ Redundant paths to communication
 - + Dedicated fibre/wireless
 - + Cellular
- ✖ Cellular – Modems with dual SIM cards

Cellular modem with dual
SIM cards capable of
automatically switching
between service providers



CCTV CAMERAS – REDUNDANT POWER

- ✖ There is an operational need to have some (not all) cameras operational under all circumstances
- ✖ Consider:
 - + Power consumption at camera sites is relatively low (typ. 1.1 Amp)
 - + Need redundant communication if the fibre path back to central is offline
- ✖ Consider using solar power as a backup to utility power
 - + MTO experience with solar powered trailer cameras up to 2 weeks of continuous operation

THINK...TRAILER CAMERAS ADAPTATION

- Consider using trailer camera **concept** at permanent camera locations:
 - + Solar panels on the camera pole
 - + Batteries/UPS to be in existing controller cabinet for CCTV
 - + Redundant communications: fibre primary with cellular back-up



POLE MOUNTED VARIABLE MESSAGE SIGNS



- Pole-mounted VMS power consumption similar to that of portable trailer signs
- Can use combination of solar and UPS/battery power
- Redundant communications
 - Primary – Fibre
 - Secondary – Cellular
- Pole-mounted VMS on the westbound Gardiner Expressway in Toronto

FULL SIZE VMS + LEGACY SIGNS



- ✖ Full-size VMS far more difficult to deal with given loading from power supplies, fans & heaters
- ✖ Consider re-wire of fans and heaters off of UPS power
 - ✖ VMS runs 4-6hrs on UPS without fans/heaters won't damage equipment
- ✖ Redundant communications
 - ✖ Primary – Fibre
 - ✖ Secondary – Cellular

Full-size overhead sign southbound on Don Valley Parkway at York Mills Rd.

CONVERTING SPARE CABINETS TO UPS

- × City of Toronto fortunate in that 3 cabinets were installed at a number of locations
- × These additional cabinets could be used to store additional batteries required for Variable Message Signs (VMS)



Original RESCU design had 3 cabinets:

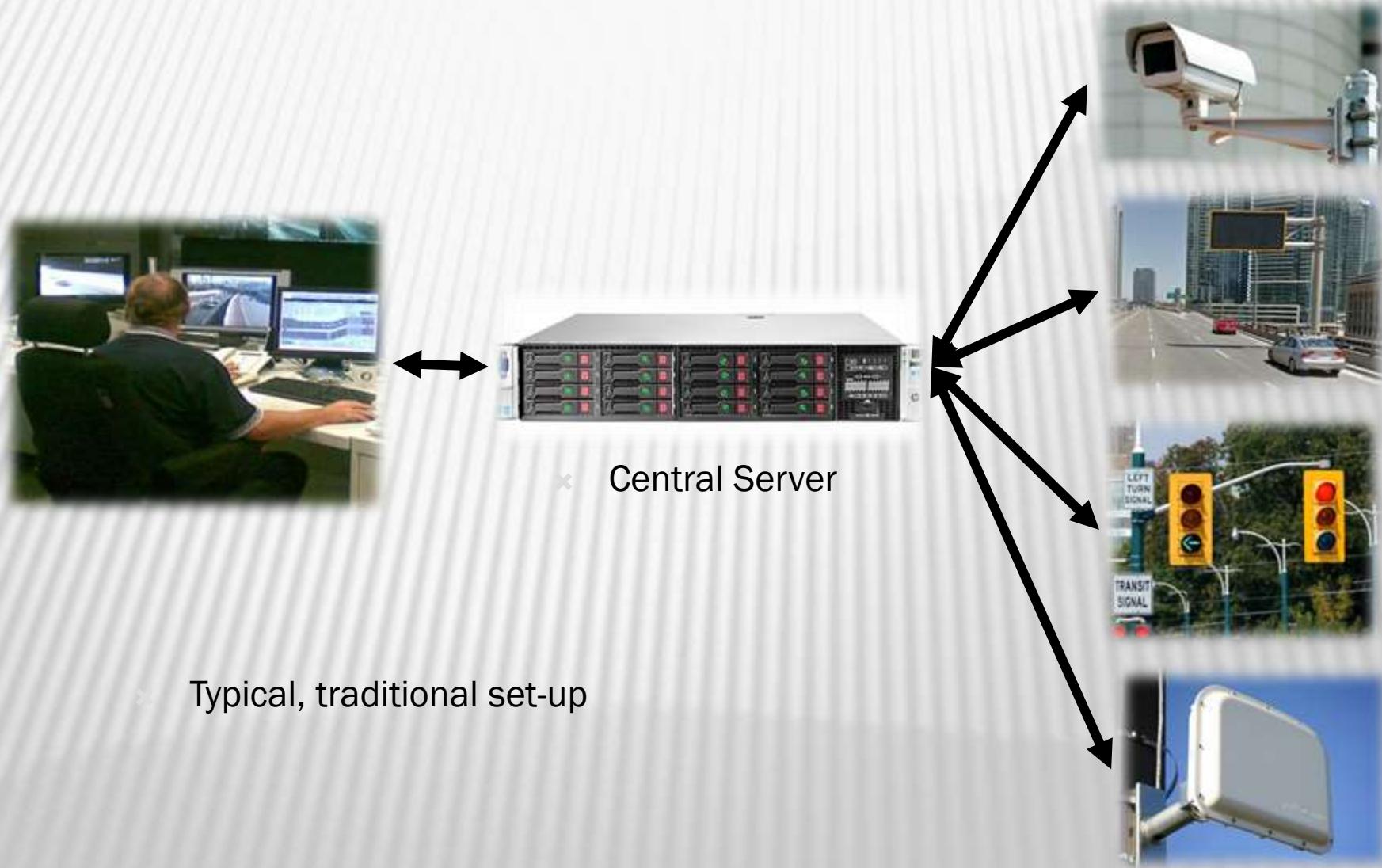
- 1 - VMS,
- 1 - CCTV
- 1 - VDS

Spare cabinets can now be used to house UPS and batteries

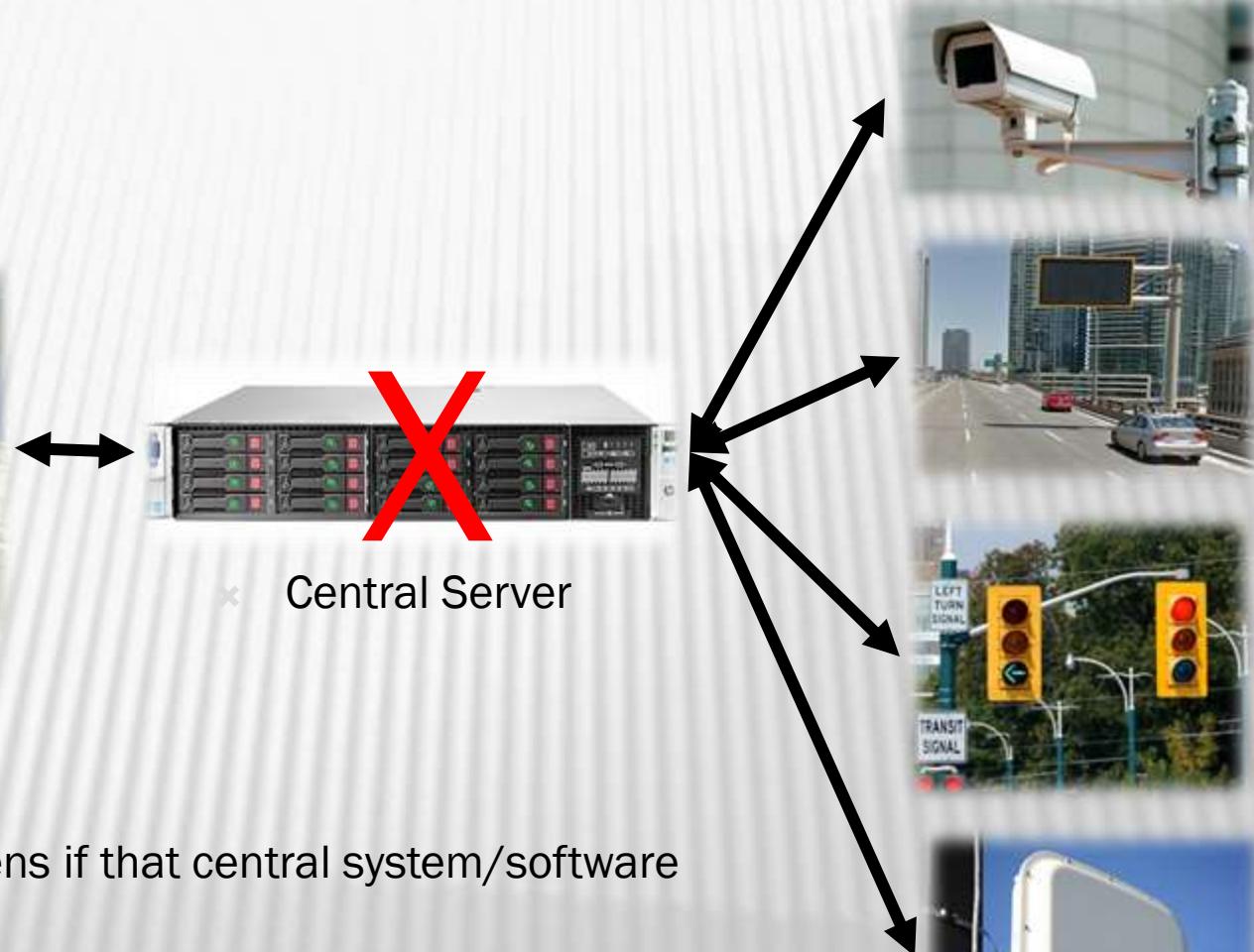
VARIABLE MESSAGE SIGNS – UPS BACKUP

- ✖ In the event of a power outage, UPS with full sized sign can be spec'd to provide operation for 4-6hrs however, operation needs to be revisited:
 - + Travel time, safety or other less critical messages to be disabled
 - + Reserve sign operating power for incident and planned related closures

CENTRAL SYSTEMS/SOFTWARE – TRADITIONAL

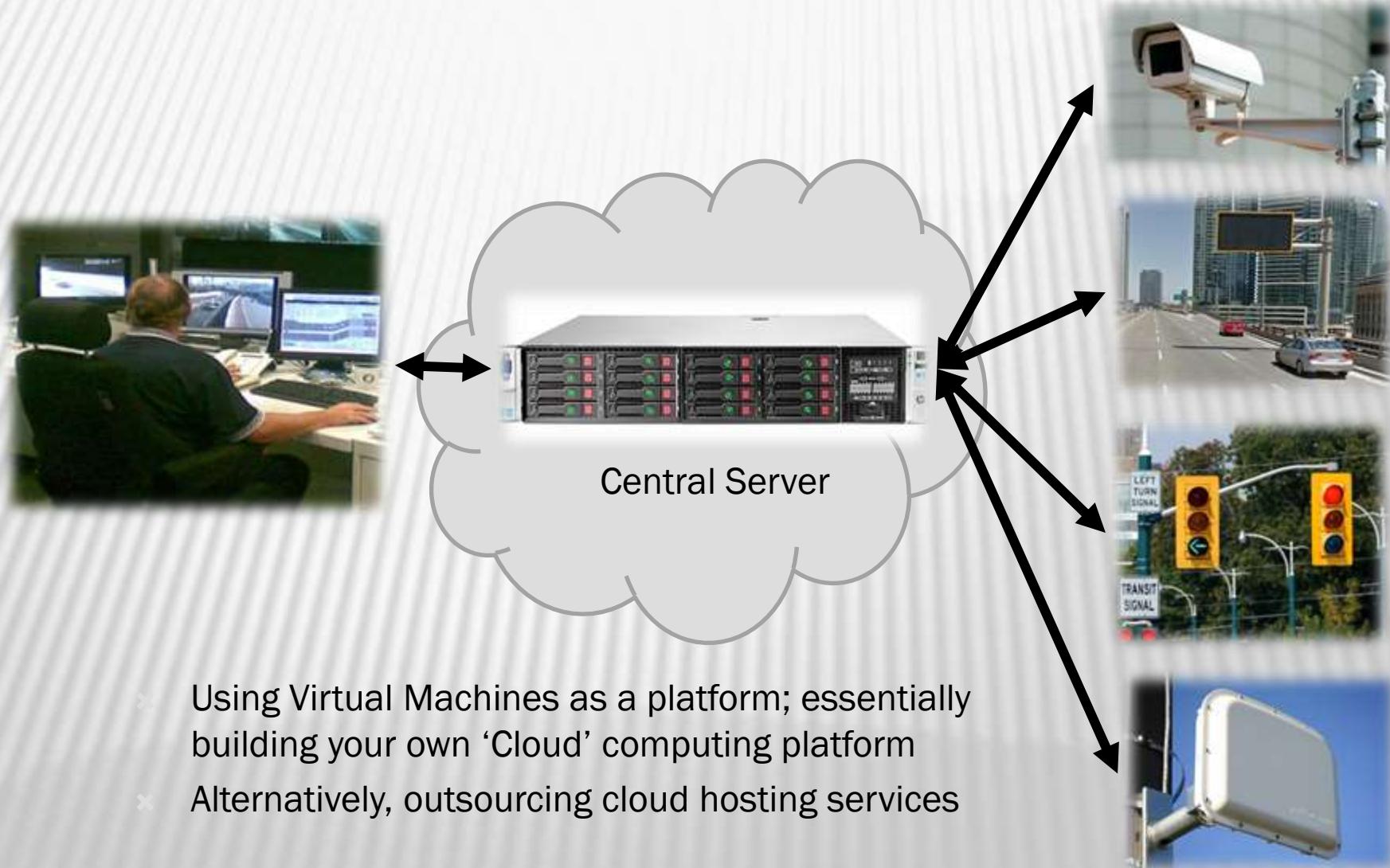


CENTRAL SYSTEMS/SOFTWARE – TRADITIONAL

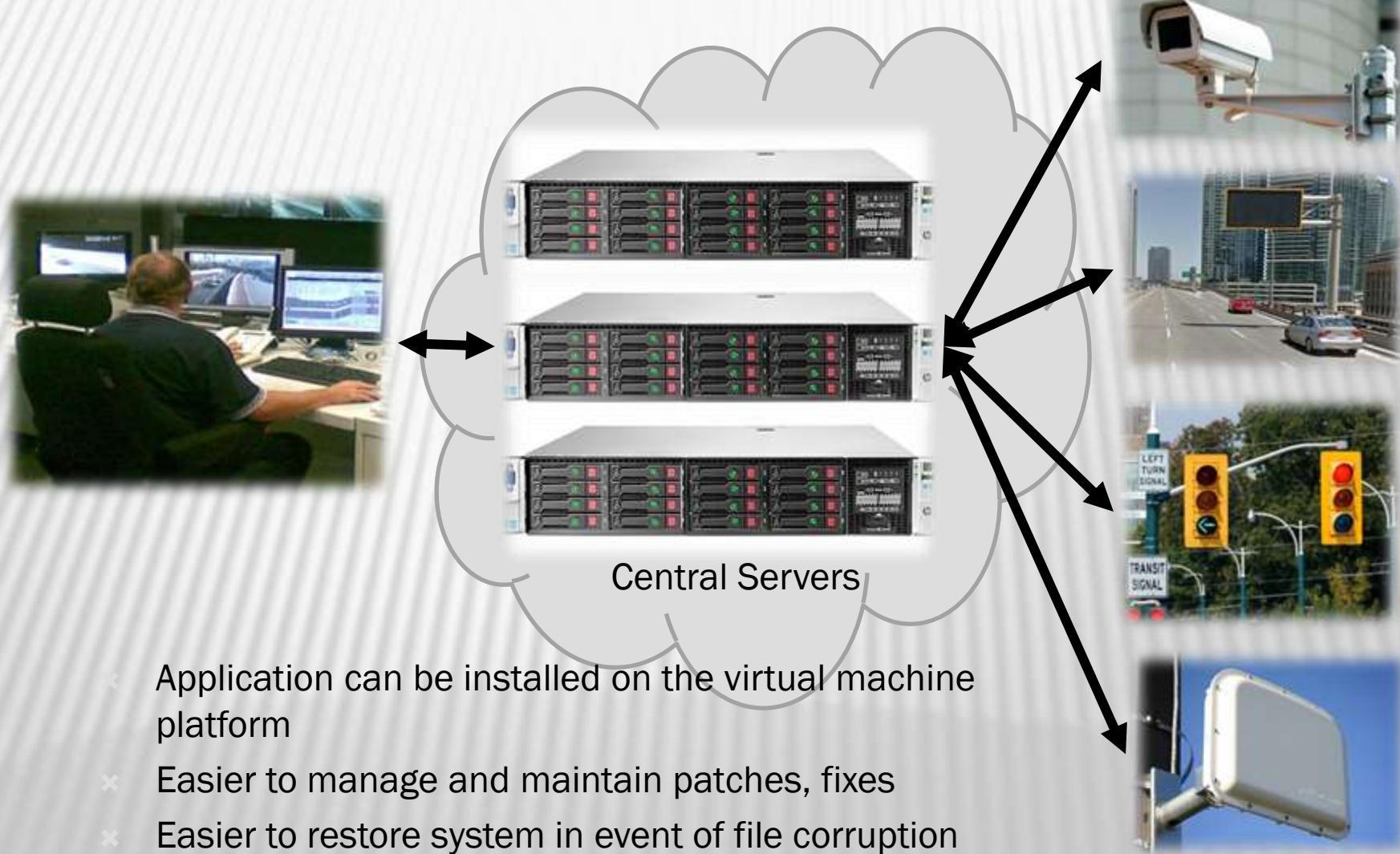


- What happens if that central system/software fails?

CENTRAL SYSTEMS/SOFTWARE – FUTURE



CENTRAL SYSTEMS/SOFTWARE – FUTURE



CENTRAL SYSTEMS – THINK THE ‘CLOUD’

- **Cloud computing approach**
 - Consider installing central software applications on multiple servers using virtual machines
 - Consider outsourcing to have central software installed on cloud hosting services
- **Redundancy and availability**
 - Cloud hosting services generally scale the computing power required to automatically meet your needs
 - They manage the system and provide the redundancy and Service Level Agreement about the availability
 - Less likely to go down in a power failure

POWER AND COMMUNICATIONS - OVERALL

- ✖ The UPS approach can become costly if you try to deploy at:
 - + Every camera site
 - + Every node site for cameras (ie switches or vmux)
 - + Every Variable Message Sign
- ✖ Using a ‘rule of thumb’ of \$10K per site, 10 camera sites already takes the capital costs up to \$100K!

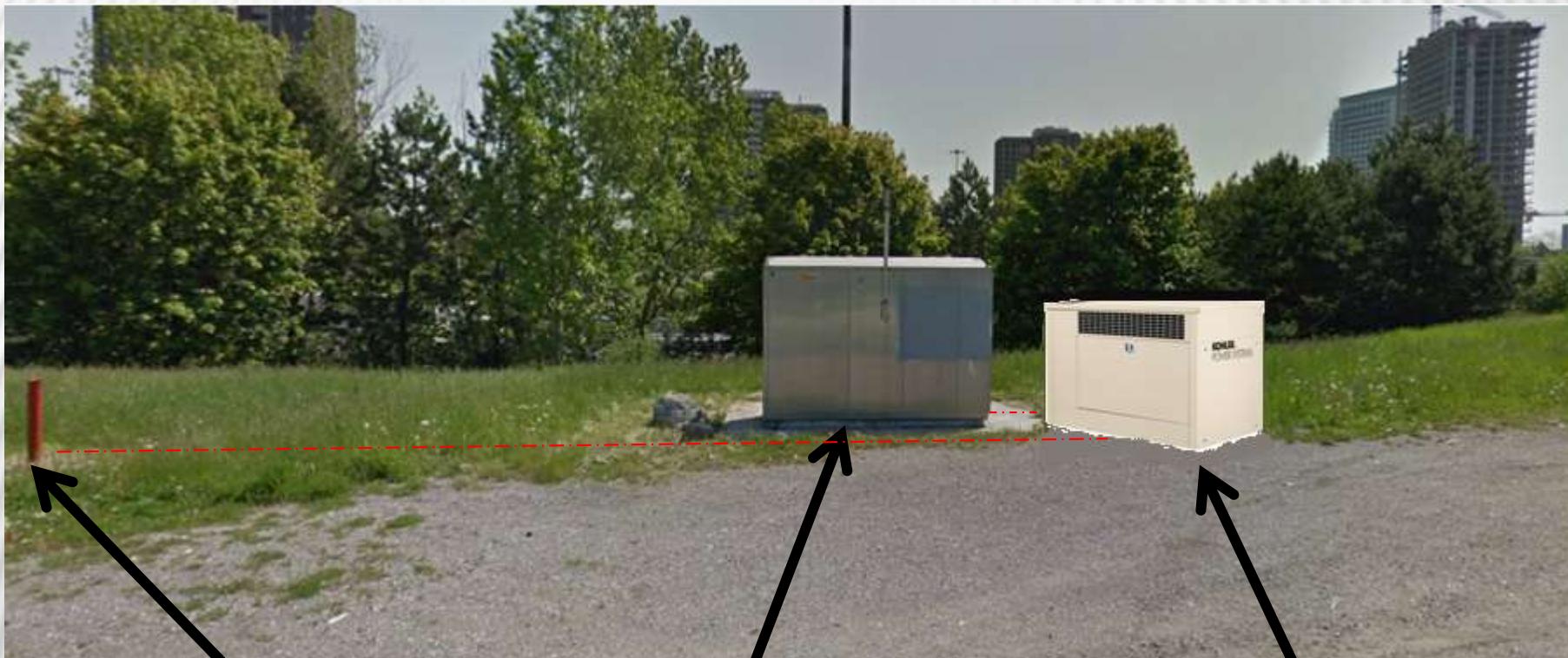
This cost doesn’t even consider maintenance costs

POWER & COMM – CONSIDER...

- ✖ Possibility to install a gas powered generator at each electrical substation
- ✖ Run a gas pipeline service to the generator
- ✖ Transfer switch in the generator so you only pay for the gas feed if there is a loss of power



POWER & COMM - CONSIDER...



Existing gas
pipeline

Electrical substation
with auxiliary panel
for ATMS

Gas powered
generator

IN SUMMARY

- ✖ Tech savvy society is setting the expectations that our Intelligent Transportation System should always be alive
 - + During power outages, other private sources of traffic information stayed alive, why shouldn't the publicly owned one be alive
- ✖ There are costs to deploying systems that stay alive however, this may simply be seen as the cost of doing business

Thank You!

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